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# Mothers stop pampering the child who won't eat when the cause of poor appetite is corrected

Lack of appetite-stimulating Vitamin B in the child's diet may now be made up with delicious Chocolate flavored Vitavose

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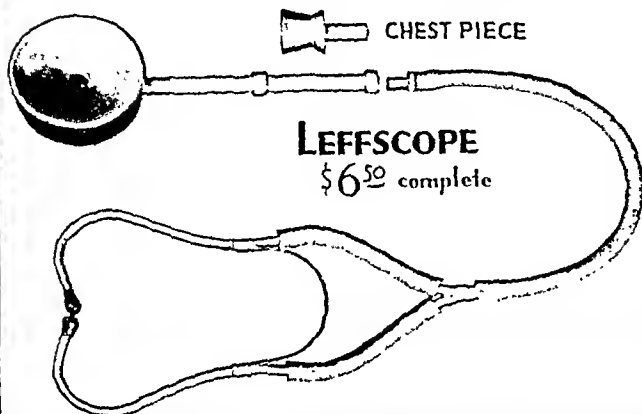
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# Help mothers end this trying, daily scene!

The child's appetite can often be stimulated by providing extra Vitamin B

You may painstakingly explain to mothers that by threatening, coaxing, and scolding, they only encourage the child not to eat.

Frequently, there's a reason for the child's poor appetite which requires the attention of a physician. It may not be a problem of behavior but of diet.

The little food which the child does eat often fails to supply him with enough of an important factor. This is the factor proved to be essential for good appetite—the *appetite-stimulating factor*—Vitamin B!

It's surprising to see how many children who are finicky at the table frequently show a lively interest in food when they are given some additional source of Vitamin B regularly.



And now it's easy to enrich their diet in this factor. With a delicious Vitamin B rich drink made with *Squibb Chocolate Flavored Vitavose!*

Three heaping teaspoonfuls of Chocolate flavored Vitavose, added to a glass of milk, supply as much Vitamin B as a whole quart of milk.

It also provides iron for the blood and other water-soluble minerals and nitrogenous compounds which greatly help to build children up.

Made from malted wheat germ, it gives children extra nutritive factors that are not supplied by ordinary chocolate milk drinks.

They like the taste of Chocolate flavored Vitavose, too! It makes a delicious drink—not too rich—just sweet enough.

Have the mother give Chocolate flavored Vitavose to the child who needs this extra Vitamin B supplement regularly with his meals and after school.



A delicious appetite-building drink for the child who won't eat! It is thirty times as rich as milk in Vitamin B.

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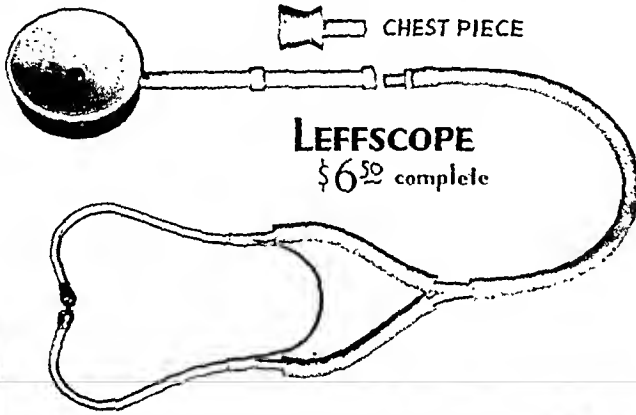
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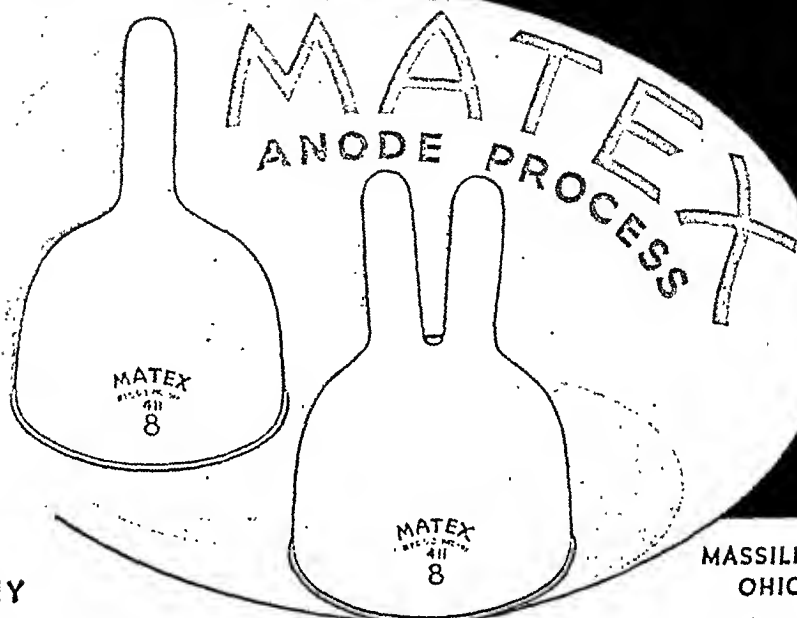
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# Should mothers *order* the child to eat?

## ...why not help make him want to eat instead?



● There's often a reason for the child's poor appetite which no amount of coaxing or scolding can overcome. Something may be holding back his normal appetite!

With many children, it is the failure to get enough of one factor which is essential for good appetite. This is the important *appetite-stimulating* factor—Vitamin B!

Often the child's regular diet must be replenished with Vitamin B before normal hunger can return.

This can easily be done now, with the help of a delicious, appetite-building drink—*Chocolate Flavored Vitavose!*

Three large teaspoonfuls of Chocolate Vitavose, added to a glass of milk, give it the Vitamin B value of a *whole quart*.

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Made from malted wheat germ, Chocolate flavored Vitavose also provides iron for the blood and other water-soluble minerals of which growing children are likely not to get enough.

No other chocolate milk drink that mothers can offer children will give them the *supplementary* factors that Squibb Chocolate flavored Vitavose provides.

Appetite as well as weight will improve with this extra help daily!

Children like to drink Chocolate flavored Vitavose. It has a delicious, *mild* chocolate flavor—not too sweet. Recommend it *daily*, at mealtime or after school.

*Fine for expectant and nursing mothers!*  
...They need much greater amounts of Vitamin B. Vitamin B helps to enrich the quality of their milk, makes it better for the baby. And it's no problem to give them a regular Vitamin B supplement with Chocolate flavored Vitavose available. It's such a pleasant drink, so easy to digest. Suggest it for mothers *every day*.



This delicious drink, given regularly to the child who won't eat, helps create an appetite! *Thirty times* as rich as milk in appetite-stimulating Vitamin B.

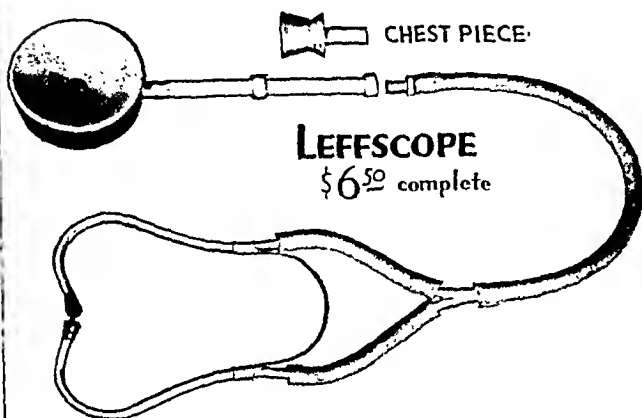
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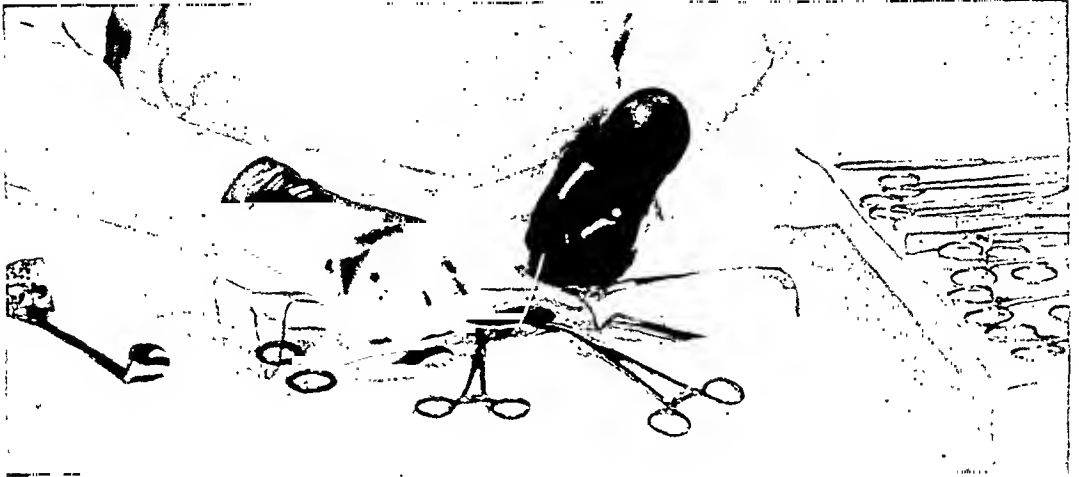
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# Mother's baby the nibbler instead of learning what causes poor appetite . . .

## Lack of Vitamin B in the child's diet is often to blame

It isn't at all unusual for the physician to find that the root of the child's trouble lies in her diet.

Mothers fail to realize the condition. They think that coaxing will bring back appetite.

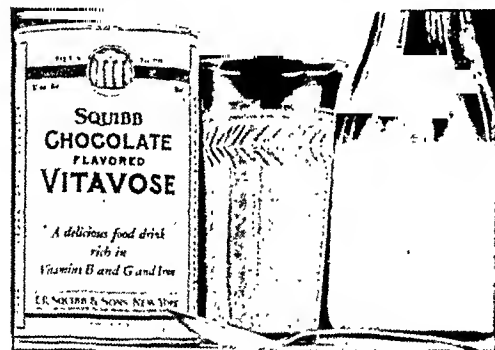
Actually, the child may need more of the important appetite-stimulating factor—Vitamin B!

Children respond quickly to the enrichment of their diet in this factor. Instead of just picking at their food, they begin to eat heartily. Gain of appetite is often followed by a gain in weight.

The next time a mother asks you how to break her child of nibbling, suggest giving extra Vitamin B.

Have the child drink *Chocolate flavored Vitavose* regularly every day!

This delicious food drink helps to make up for a lack of Vitamin B in the child's diet and to restore normal, healthy appetite.



A delicious food drink which helps build an appetite in the child who won't eat. It is *thirty times* as rich as milk in Vitamin B. Have mothers give it regularly every day.



Three heaping teaspoonfuls in a glass of milk supply as much Vitamin B as a whole quart of milk.

Chocolate flavored Vitavose is also rich in iron and nitrogenous compounds of the wheat embryo that growing children need.

Children who are thin and pale thrive on it! And they enjoy this food drink.

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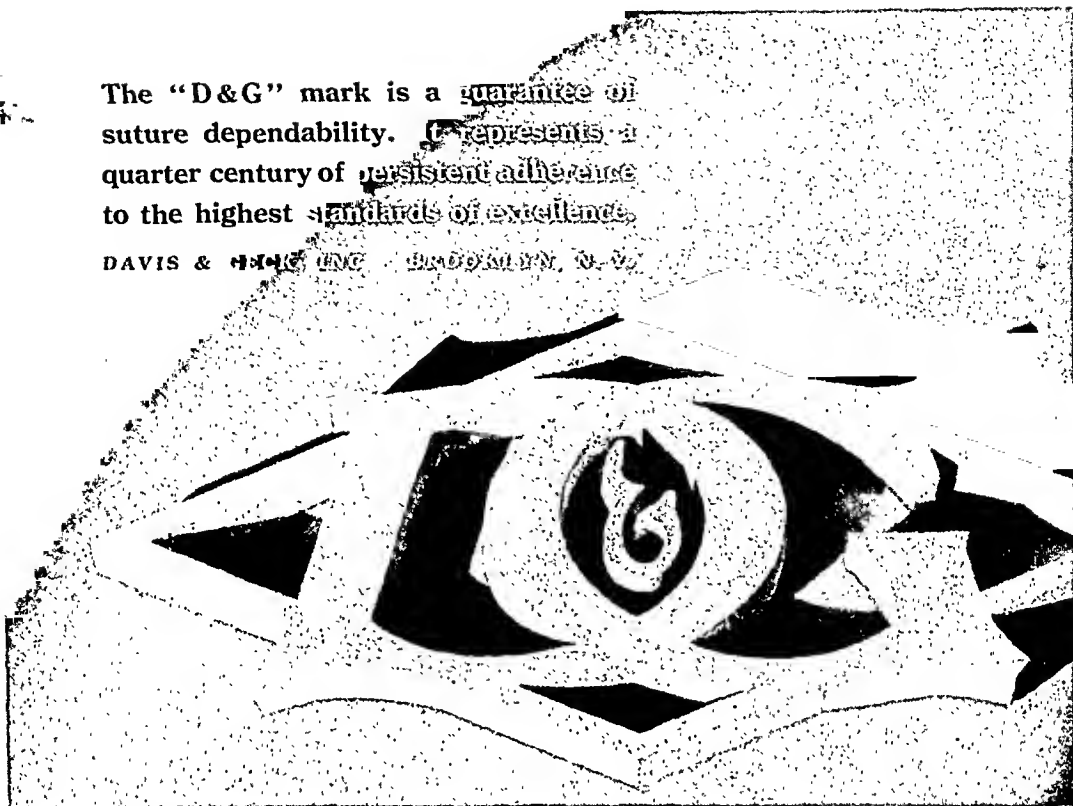
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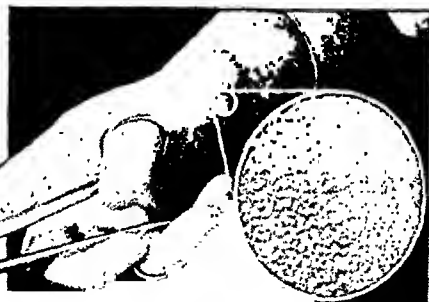
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# American Journal of Obstetrics and Gynecology

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No. 1

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## Original Communications

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### THE COMPLICATIONS OF RADIUM THERAPY IN GYNECOLOGY\*

GEORGE GRAY WARD, M.D., F.A.C.S., NEW YORK, N. Y.

*(From the Clinic of the Woman's Hospital)*

THAT facilities to treat cancer patients must be established in our general hospitals throughout the country as well as in the large special institutions such as the great cancer clinics of Stockholm, Paris, Munich, and New York, is inevitable, because the patients suffering from cancer are already far too numerous for these centers to take care of and the disease is steadily increasing.

This means the staff of the general hospital must be educated to a proper appreciation of the complexities of this disease, and must be trained in the most approved technic of radium therapy as well as surgery, for without this agent available no hospital today can be considered properly equipped.

On superficial thought the acquiring of this knowledge and technic of radium therapy seems a comparatively easy matter as the application of the element appears so simple. The alluring advertisements of the commercial agencies who rent radium, urging the general practitioner to send a description of the case, and they will forward directions with the proper dosage of radium, apparently confirms the prevailing impression that any one can apply it without special knowledge or skill.

Let me emphasize the warning of Madame Curie on her last visit to this country when she called attention to the great dangers of the improper use of radium. As Regaud, of the Paris Clinie, has recently said, "It is necessary to have much experience to obtain from this method of treatment all the good that it may give without the evil that it may do."

"Correspondence Courses" in radium therapy are dangerous for the

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\*Read at a meeting of the Brooklyn Gynecological Society, May 6, 1932.

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NOTE: The Editor accepts no responsibility for the views and statements of authors as published in their "Original Communications."

inexperienced. While the renting of radium from these agencies is of course perfectly justifiable, the knowledge and judgment as to how and when to use it can only be bought by careful study and personal experience and observation in radiologic clinics. Indeed radium is a two edged sword, and its use is far from simple.

To appreciate this we must first have some knowledge of the action of radium on the tissues. Radium does not remove a cancerous growth by destruction of the entire part affected as is accomplished by surgery or cauterization, but the gamma rays have a direct selective action on the cancer cells, destroying them without injuring the normal cells at the site of the neoplasm.

This is demonstrated in healed cases of carcinoma of the cervix, where the normal shape of that organ may be restored with no trace of the site of the growth.

Another action of radium is to cause the proliferation of connective tissue. The connective tissue contracts, with the resulting obliteration in great degree of the blood and lymph supply, producing the contracted, pale looking cervix and funnel shaped vaginal vault, that we see in the ideally healed cases.

If the dosage suitable for a certain case is used, we will destroy the cancer cells but *not* the normal tissues, owing to the selective action of the gamma rays on the carcinoma, and the greater resistance or toleration of the normal tissues.

If we give much larger doses of radium than is required to destroy the cancer cells, we will also destroy the normal structures and produce extensive necrosis with its resulting septic absorption, hemorrhages, and injury of adjacent viscera, with perhaps the production of fistulas.

Remember also that these unfortunate results of overirradiation with this powerful element are commonly attributed to the extension of the carcinoma, or frequently the action of the radium is blamed and consequently condemned as of no value.

We must see also that if too small an amount of radium is used, or for too short a time, that we may fail to destroy all the cancerous tissue.

Upon the proper screening of the radium depends the elimination of the beta, or burning rays, which cause extensive destruction of the normal tissue. Various metal containers of different thickness are used such as platinum, gold, silver, or brass for this purpose, and damage of the bladder and rectum is avoided by "distance screening," that is pushing them out of reach of the rays by overdilating the vagina with gauze. If inadequate screening has been used, unnecessary necrosis will result.

Too frequently repeated radiations, especially if a heavy dosage for prolonged periods is employed, will result in the so-called "late reaction" of radium. Six months, or a year or more, following the initial treatment dense infiltration, pelvic pain, ulceration, and discharge may develop, which is apt to be attributed to a *recurrence* of the disease, when

actually it is the result of an overirradiation of the tissues with a resulting excess of connective tissue formation. This produces a slowly developing obliteration arteritis, and the devitalized structures ulcerate and become a ready prey to infection.

From this brief summary of the action of radium on the tissues and the damage that it may cause by a defective technic, it should be appreciated that safety in its use depends on the *careful study* of the *location* and *extent* of the disease, of the *type of cell* and the *degree of its maturity*, of the *general physical state* of the *patient* as to *age*, *blood condition*, and *toxemia*, of the *careful preoperative preparation* of the patient, of the *amount of radium used* and its *distribution in appropriate containers*, on the *proper employment of screening to cut out the burning rays*, on the *placing and maintaining* of the *radium in situ* where it will destroy the cancer and yet not damage adjacent viscera, on the *duration* of the application, and the *time and dosage of reradiations* and *deep x-ray therapy*, and finally on a *careful frequent follow-up*.

A personal experience in studying the action of radium on this disease over considerable periods of time is essential before one can become competent to properly treat cancer of the uterus with radiotherapy.

The complications that we may encounter in radiotherapy of the uterus are many. Some of them we cannot avoid, but the incidence can be materially reduced by following the accepted technic of those experienced in its use.

It is of interest to note that in the enormous mass of literature that has been published on radium therapy, while the complications are mentioned, it is rare to find a detailed analysis of the subject.

Very little has been written regarding the frequency of postradiation symptoms, yet as they are encountered in all clinics, varying from mild temporary discomforts to severe and most distressing complications, involving prolonged suffering and even death, it would seem of value to study this phase of radium therapy in the hope of reducing their incidence.

We have recently had an analysis made of 558 cases of carcinoma of the cervix in our clinic, and there were 119 who had some form of post-radiation morbidity, or 21.3 per cent.

In 106 cases of carcinoma of the fundus, of which 88 were treated by radium, 11.4 per cent had complications.

This study shows that there has been a gradual decline in the frequency of complications in the latter years in this series. This is probably due to the more meticulous attention paid to the details of the technic and to an improvement in judgment as a result of our experience.

The primary mortality from radium therapy in carcinoma of the cervix should not exceed 2 per cent. It should be nil in the early cases (Class I and Class II). In our last published series it was 1.1 per cent, with none for the Class I and II cases. This mortality is nearly always



due to the unwise employment of radium in cases with extensive disease in which an acute sepsis is present or results.

When the destroyed carcinomatous tissue sloughs away as a result of the action of the radium, a certain amount of bleeding (secondary hemorrhage) will occur in some cases, which varies in amount from a moderate oozing to a severe hemorrhage in those cases where the disease has encroached upon the blood vessels, and may require prompt packing.

In our series we have had some bleeding in about 10 per cent, but very few were of the severe type.

Vesical irritability and rectal irritability as a result of the action of the rays on the bladder and rectum is mentioned as a frequent complication by many clinics.

In our hands we have had comparatively few cases where this has been troublesome, approximately 4.5 per cent.

We believe that this is due to the meticulous care we use in distending the vagina to the utmost with gauze packing, thus getting the maximum value of "distance screening."

As we have observed the technic in some clinics this extreme distention of the vagina is not always done.

We believe also that the use of a self retaining catheter in the bladder while the radium is in place, helps by keeping the bladder collapsed, as the full bladder lies close to the anterior uterine wall and the radium in the uterine cavity, which has a penetration of about 3.5 cm., can easily reach the bladder.

Radiation cystitis is manifested by frequency and dysuria, and may be very troublesome and last for a long time, as ulcerations may result.

Proctitis is evidenced by diarrhea, rectal pain and ulcerations. Our incidence was 3.1 per cent. Most writers speak of this as a more troublesome complication than cystitis.

These ulcerations of the bladder and rectum are often mistaken for an extension of the carcinoma.

Vesicovaginal fistula is one of the most distressing complications that we meet in radium therapy. It is frequently difficult to tell whether the fistula is a result of the extension of the disease or of the radiation. Should the disease invade the anterior vaginal wall, there is great danger that a fistula may be produced if the dosage is too large.

Judgment as to the proper dose must be based on the thickness of the septum and upon experience.

I believe one of the most dangerous conditions we have to deal with is in those cases where a previous supravaginal hysterectomy has been done and cancer has developed in the cervical stump.

The bladder then lies on top of the cervix at the site of the amputation where it will come in direct contact with the radium tube placed in the cervical canal.

We have seen 40 cases of cervical carcinoma which had had a previous

hysterectomy in our series of 558 cases, or 7.2 per cent. Some of these developed a fistula, whether from the radiation or the disease we are not sure. In these patients the incidence of hemorrhage was increased one and one-half times, and of fistula two and one-half times, so in recent years it has been my practice to reduce the radiation one-half in these cases, repeating as necessary.

Vesicovaginal fistulas do not tend to heal of themselves. In two instances I have successfully closed these postradiation fistulas by operation.

CASE 1.—Miss M. J., aged thirty, came under my observation in February, 1927, with carcinoma of cervix Class III, squamous cell Group I. She was given 4200 mg. hours. She had considerable slough and did not respond well, became cachectic, lost weight and developed a vesicovaginal fistula in the anterior vaginal vault 2 cm. in diameter. She entered the House of Calvary as a hopeless case, but to our astonishment returned to our follow-up clinic in December, 1927, with no evidence of the disease and feeling perfectly well except for the fistula. I successfully operated upon her in February, 1928, and she has remained in excellent health to date.

CASE 2.—Mrs. M. S., aged forty-three, had had an amputation of the cervix followed by radium therapy for carcinoma in a neighboring city in November, 1927. She came to the Woman's Hospital in January, 1929, suffering from a vesicovaginal fistula in the vault and dense infiltration of the entire anterior vaginal wall and a severe cystitis. She was thought to have a metastatic invasion of the bladder and seemed a hopeless case. On passing a sound into the bladder, a click demonstrated the presence of a large calculus which was firmly imbedded in the trigone and which gave the impression of a dense infiltration. I did a cystotomy from above, removed the stone and drained; the bladder promptly cleared up, and she rapidly recovered with no evidence of carcinoma. The fistula I attempted to close in May, 1930, but failed. It was an exceedingly difficult case owing to a small contracted vagina and dense scar tissue forming the margins of the fistula. I tried again in February, 1931, with the same result. In December, 1931, a third attempt was perfectly successful. I succeeded this time because I first dissected out the entire funnel shaped vault of postradiation scar tissue, in the apex of which was the fistula.

Rectovaginal fistulas sometimes heal of themselves, but the most troublesome cases are those which develop an ileovaginal fistula. On account of the liquid state of the stools, which are intensely irritating, these patients suffer excruciatingly. This complication may be caused by a loop of the small intestine being adherent in the culdesac or to the posterior surface of the uterus, and excessive radiation or the extension of the disease results in the fistula. We had such a case due to the extension of the disease as proved by autopsy, in which three loops of small intestine were adherent to the back of the uterus and culdesac.

The most unusual case of rectovaginal fistula we have encountered was as follows:

Mrs. E. O., aged twenty-seven, came to the clinic in July, 1926, with a carcinoma of the cervix Class III, Group I. She was radiated but did not respond well, and as she seemed in a hopeless condition entered the House of Calvary in January, 1927. She returned to us in September, 1927, apparently free from carcinoma. In February, 1930, she developed a pelvic abscess which resulted in a fecal fistula between the upper sigmoid and the vaginal vault. The fistula, however, was small and did

not trouble her greatly unless her bowels were loose. In February, 1932, she developed an acute cellulitis over the center of the posterior surface of the sacrum which we felt certain was due to bony metastasis, although the x-rays were negative. On March 8, 1932, I opened this abscess and the next day a fecal discharge was in evidence. X-ray studies showed that this sinus ran through the sacrosciatic notch to the original fistula which thus discharged through the vagina and through the back over the sacrum. On March 29, 1932, I made a temporary colostomy and the sacral sinus has closed and the vaginal sinus nearly so. There is no evidence of carcinoma to be determined and she seems perfectly well nearly six years after her original radiation. It is our intention to close the colostomy should the vaginal fistula heal.

There were 22 cases of fistulas in our series of 558 cases, or 4 per cent. What proportion were due to the radiation and what to the disease it is not possible for us to determine.

We believe that cases having a history of previous pelvic inflammatory disease with or without operation are liable to intestinal fistula as a complication of the treatment or the disease on account of the proximity of an adherent loop of bowel to the site of the disease.

As a result of the contraction which follows radiation, due to formation of dense connective tissue, the cervical canal may be partially or completely occluded. An infection of the endometrium of the uterine cavity frequently results, and a condition of pyometra develops with or without retention. Cramplike pains due to uterine contractions and enlargement and softening of the fundus are suggestive signs.

A monthly follow-up of all cancer cases such as we have at the Woman's Hospital enables one to discover this complication in its incipency, and the passage of a sound makes the diagnosis and corrects the condition.

Pyometra was a complication in 3.6 per cent of our series.

The primary mortality in radium therapy is almost always due to the lighting up of a septic infection which results in peritonitis. The carcinomatous cervix with its sloughing and ulcerated surface is likely to harbor pathogenic bacteria. Preliminary vaginal antiseptic douching should be employed. Trauma in dilating the cervix and placing the radium should be avoided. A biopsy is safest when done with the radio knife. The presence of a temperature and signs of pelvic inflammatory disease should indicate rest in bed for a few days as a preliminary measure.

Anemia and asthenia should be combated with a blood transfusion prior to the radiation.

A temperature reaction up to  $101^{\circ}$  may be considered as normal immediately following the application of radium, but it should promptly subside. High temperature after radium therapy was formerly attributed to the absorption of toxic substances from the disintegrating tumor, but it is now known to be from infection. We are inclined to believe that the high incidence of sepsis following radiations in some clinics may be due to the daily and repeated intrauterine applications.

In our clinic the incidence of sepsis as indicated by a temperature of 102° or more is but 2.7 per cent.

The contraindications to radium therapy are few, except in cases with an active septic infection and peritonitis, and in advanced Class IV cases with frozen pelvis.

Sloughing ulcer from over irradiation and insufficient screening, which means destruction of normal tissues as well as the carcinoma, should be preventable.

Late reactions coming on six months or a year after the initial treatment and which are frequently mistaken for a recurrence of the disease are likewise usually due to over radiation.

Radium burns in normal tissue from displacement of the radium is apt to occur if the applicators are not anchored in place. We believe this is an important point in the technic of application as shown in the following case:

Mrs. S. had had radium and x-ray therapy for nonmalignant metrorrhagia. She came to me three months later suffering excruciating pain in her vagina and a foul discharge. Examination disclosed a sloughing ulcer in the right lateral vaginal fornix the size of a quarter with acute vaginitis and infiltration. The possibility of malignancy was considered but a biopsy proved there was no malignancy. The ulcer was evidently due to a radium burn from the applicator becoming displaced alongside the cervix. After five months of suffering the ulcer entirely healed with complete relief from pain.

Nausea and vomiting occasionally occurs while the radium is in place but was noted in less than 1 per cent of our cases.

The contraction of connective tissue formation in the broad ligaments is a late complication and may produce an obstructed ureter and involvement of the kidney. Severe deep seated pelvic pain, if not due to the disease, is probably the result of connective tissue contraction. Stricture of the urethra also has been observed.

Phlebitis involving the leg may occur. We encountered it in 0.54 per cent.

In the 106 cases of carcinoma of the fundus we have encountered, 88 were treated by radium therapy, either alone or in combination with surgery. We prefer to give an intrauterine application of radium at the time of the diagnostic curettage in these cases followed by a pan-hysterectomy four weeks later. In about 50 per cent of these patients we have been compelled to use radiotherapy alone because they were poor operative risks. These fundus cases were less apt to have complications than the cervix cases, as there were twice as many complications in the latter. It is noteworthy that postradiation hemorrhage did not occur at all in the fundus cases, while pyometra was more frequent, being met with in 4.6 per cent as compared to 3.6 per cent in cervix carcinoma.

As we would expect, proctitis is one-third less frequent than in the cervix patient.

One of the most distressing complications we can encounter from radium therapy is when it is used to check a menorrhagia in a young woman and an overdose is given.

In such intractable bleeding cases which do not yield to curettage or hormone therapy success may be achieved with a very small dose of radium, 200 to 400 mg. hours. If we approach 600 mg. hours we are in danger of causing a permanent amenorrhea and atrophy.

It is far better to underirradiate these cases with the understanding that the treatment may have to be repeated, than to give too much.

Miss V. R., aged twenty-five, and socially prominent, was brought to me by her mother for an amenorrhea of one year's duration and menopause symptoms following an intrauterine application of radium for a persistent menorrhagia which had not been relieved by repeated curettage. The examination disclosed an atrophic uterus with a contracted canal. On inquiry, her physician stated to me that he had called in a radiologist who had given the patient a dosage of 1440 mg. hours. She was of course beyond relief, and as she wished to get married the family were greatly distressed.

I know of a similar instance of an inexcusable over dosage in a young girl.

#### CONCLUSIONS

Since 1919 to date we have had in our cancer clinic some 560 cases of carcinoma of the cervix and 106 cases of fundus carcinoma.

A study of these cases shows that approximately 19 per cent have had some form of complication, although the large majority have been of a minor and transitory type.

We cannot always avoid some of these complications as they occur in the most experienced hands, but they can be materially reduced in number, if the action of radium on the tissues is understood and meticulous care is taken in following the essential details of the preliminary treatment and technic of application.

It is just as necessary that men should be properly trained in the treatment of cancer of the uterus by radium therapy, if satisfactory results are to be obtained, as that they should be properly trained in surgery.

As Lord Moynihan has stated, "The surgeon's knife in most highly trained hands is an instrument of great delicacy, but it cannot always discriminate between healthy and diseased tissues. Radium is an instrument of far greater delicacy because its action is selective, that is to say, it acts differently upon diseased and healthy tissues, killing one and leaving the other."

Finally I desire to emphasize the fact that the safe employment of radium requires experienced piloting as we are literally sailing between Scylla and Charybdis in attempting to avoid the damage we may inflict by overirradiation on the one hand and the failure to destroy the disease by insufficient radiation on the other.

## DISCUSSION

DR. HARVEY B. MATTHEWS.—Complications, both severe and mild, are known to follow the use of radium, but very few of us have taken the trouble to tabulate our cases as Dr. Ward has done in an effort to ascertain the complications that actually occur. Dr. Ward has tabulated every complication except perhaps one, a severe vaginitis, very intractable, causing considerable disability, but after a long period of treatment, finally healing.

The late complications including the indurated cicatricial scars in the broad ligaments, are not always due to irradiation, but are aggravated by it and become more solidified, almost cartilaginous in character. It is no wonder that they produce very severe, disintegrating, continuous pain. If the ureter is in the scar, then we have superimposed the symptoms caused by this complication.

Dr. Ward did well to insist that this work needs special training. Experience is required not only in the treatment of the cervical and body cancer cases, but the nonmalignant uterine bleedings as well.

DR. WILLIAM SIDNEY SMITH.—We use radium at the Brooklyn Hospital very similarly to the manner in which Dr. Ward uses it. Our service is small. I would like to urge the value of heavily screened radium and that you are much less likely to get into difficulties than if you use radium screened so that the Beta rays get through. We use radium screened with a full millimeter of platinum and have had but few bladder complications (cystitis, etc.) and very few rectal complications, than elsewhere, because in early carcinoma of the cervix we almost always use it in conjunction with cautery. If the case is early, and the cervix can be pulled down, we do a Byrne cautery operation and then put the radium in the cavity. If the case is farther advanced, with some induration, and the cervix will not come down, we often sear off the sloughing mass with the cautery and then insert the radium, either in the form of a T with one capsule within the remainder of the cervix and the other crosswise against it, or we use both capsules in parallel right up against the cervix. It is interesting to note that our only bladder fistulas have followed operations in which the cautery was used. In one case in which a Byrne cautery operation was done radium was inserted for 2,400 hours, the patient was sent for x-ray and she was given heavy x-ray dosage which, by the way, caused a great deal of shock. In two months we gave her another dose of radium (2,400 hours) and the x-ray was again tried, but the shock was so great she was only given one dose. That was nine years ago. She is still alive, but has had a bladder fistula for five years. There is a great deal of induration in her pelvis and very little mobility. I have advised her against trying to have the fistula repaired because I think it might light up her carcinoma. She gets along fairly well with it.

The other fistula occurred after a cautery amputation of a carcinoma of the cervix with the radium laid against it. Her carcinoma seemed to be fairly well healed for a time, then the fistula developed. It was closed by operation for about six months, and then broke down, the carcinoma lighted up, and she finally died.

DR. DAVID FEINER.—The mischief that can follow the improper introduction of radium, is shown by a case of a woman who was in labor at home for about twelve hours under the care of a midwife. When brought in the cervix was three fingers' dilated, the cord prolapsed and a foot protruded. A physician was called in who did not recognize the pathology that was present and tried to do an extraction. The patient was about seven months pregnant. He thought the child was undersized and would come out without much difficulty. He desisted after he had removed the body up to the neck, and the latter snapped, with the head remaining inside. I then saw the patient and found a dense cicatricial stenosis of the cervix with marked fibrous replacement of the entire vault of the vagina. The head was oversized, ap-

parently hydrocephalic. We tried to incise the cervix and made very little progress because of the severe bleeding. We finally did a laparotomy and removed the uterus with the contained head. On subsequent inspection of the uterus and microscopic examination of the sections of the lower segment the cervical portion showed extensive fibrous replacement of the muscle tissue and undoubtedly in this case in which radium had been used, the cavity of the uterus was not packed to keep the tube up near the fundus where it belonged, but was allowed to prolapse down to the cervical canal and brought about cicatrization and stenosis.

DR. GEORGE G. WARD.—Vaginitis may occur, although we have had very little difficulty with that complication. In one instance there was definite sloughing of the vaginal mucosa which caused a good deal of trouble. I have always felt that the marked distention of the vagina with gauze was a preventive.

As for involvement of the bladder, it is not uncommon in our experience when we send a case to the urologic department to have a report that there is metastasis in that organ. In quite a number of instances this has proved not to be the case, but a bullous edema and possible ulceration was there, due, undoubtedly, to the radiation. Those cases have in a number of instances entirely cleared up although they have a prolonged convalescence. We must not immediately jump to the conclusion that it is carcinoma of the bladder, and must remember that it may be due to the radium.

For a long time I feared that the repair of a postradiation fistula might light up latent cancer cells imprisoned in the connective tissue. Our pathologist examined all tissue removed in cases of vesicovaginal fistula and in no case were carcinoma cells found in the cicatricial tissue around the fistula.

The difficulty of removing radium is an important matter and that is why we have developed the particular technic employed. The displacement of a tube of radium from the canal is due to the contraction of the uterus. That is why we anchor the radium in place.

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## THE TECHNIC OF RADIATION THERAPY IN UTERINE CARCINOMAS\*

HENRY SCHMITZ, A.M., M.D., F.A.C.S., F.A.C.R., CHICAGO, ILL.

THE criteria of an adequate radiation tissue dose delivered into a deep seated or internal carcinoma are a rapid resolution of the growth, a restoration of the surface epithelium and a limited fibrosis. The predetermined radiation tissue dose evidently should be uniformly or homogeneously distributed throughout the cancer bearing area. The radiation dose should be lethal to the carcinoma cells and should not cause irreparable injury to the normal tissue lying within the radiation field.

The good end-results depend not only on an adequate, homogeneous radiation tissue dose but also on the location of the growth, on the clinical extent of the tumor, the degree or grade of histologic malignancy, the presence of complicating infections and the general constitutional state of the patient as determined by age, cachexia, toxemia, complicating diseases, etc. These factors are only mentioned since the following discussion is limited to the technic of radiation therapy.

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\*Read at a meeting of the Chicago Gynecological Society, February 19, 1932.

The lethal radiation tissue dose for sarcomas and carcinomas has been tentatively placed by Wood and Prime<sup>1</sup> at about 4.5 to 7 erythema doses of filtered roentgen rays or gamma rays applied to the tumor. The tumor should be rapidly growing, very cellular and highly malignant. These are characteristics associated with a high degree of radiation sensibility. Wood<sup>2</sup> further states that the production of absolute permanence of cure by radiation therapy implies that the destruction of the tumor cells must be as complete as must be their removal for effective surgery. These findings have been corroborated by clinical experiences as reported by Quick,<sup>3</sup> Lee,<sup>4</sup> Pfahler,<sup>5</sup> Schmitz,<sup>6</sup> and others.

The radiation tissue dose for highly cellular and highly anaplastic undifferentiated carcinomas of the uterus is probably 4 to 5 erythema doses according to our observations. It is necessary to apply this intensity uniformly throughout the true pelvic cavity. The methods employed to accomplish this will be described in the following discussion.

#### PHYSICAL PRINCIPLES OF DEEP IRRADIATION THERAPY

The physical principles of the production of x-rays and radium must be known in order to obtain the best results in the treatment of malignant diseases by radiation. It was deemed desirable therefore to discuss some facts of a rather technical nature such as the methods of application of radiations, the relation of the time duration of radiation to the total dose, the factors to be observed and to be recorded on the treatment charts, and the definitions of the erythema dose, designated E. D. and of the international roentgen dose unit designated "r."

Radiations may be applied cavitarily, interstitially or distantly. The insertion of radium into the cervical canal or the uterine cavity is a cavitary application. The introduction of the needles containing radium or radon into the tumor, as in the pallisading of the cervix or paracervical tissue, is an interstitial method. The application of roentgen rays or of radium contained in a so-called cannon is a distant method.

The time duration within which a complete radiation series is given may vary. The application of the full dose may be done within the shortest possible space of time. This single "massive intensive" method is advocated for roentgen rays by Kroenig and Gauss,<sup>7</sup> and Seitz and Wintz,<sup>8</sup> and for radium by Kelly and Burnam,<sup>9</sup> Healy<sup>10</sup> and others. The tolerance tissue dose, that is the highest dose tolerated by normal tissues without serious primary injuries is applied in a single continuous sitting, the dose being about 250 per cent E. D. Additional radiations are not advisable. If reradiation is necessary then a decreased dose may be applied six to twelve weeks later. It is a well established axiom that the first course of radiation treatment should be applied in such adequate doses that the growth will be arrested, since radiations added at a later time are as a rule ineffective.

An erythema dose may be given at once and followed by the additions of smaller doses at stated intervals of three to seven days until a total



dose of 2 to 2.5 E. D. has been attained. In this way the radiation effect is maintained at full saturation. It is known that the loss of radiation effect of the short wave radiations used in deep cancers amounts to 4 per cent daily; hence 12 per cent of an erythema dose may be added every third day, or 25 per cent of an erythema dose every seven days until a total dose of 2 to 2.5 E. D. has been given. The "saturation" method was introduced by Pfahler<sup>11</sup> who based the observation on earlier data of Kingery.

A fraction of a dose, for instance, 40 per cent of an erythema dose may be applied every third day 5 times, or 30 per cent of an erythema dose may be given every third day 10 times. In other words the *fractional* dose is *scattered* over fifteen to thirty days. The *scattered fraction* method has been employed in our clinic for the last twelve years. In Europe it is known as the Contard protracted fractional method.

In the Contard method small ampere loads are used so the single treatment is applied within an hour, i. e., it is protracted. We use loads of 25 to 30 milliamperes and the application of each fractionated dose lasts from ten to fifteen minutes depending on size of filter and focus skin distance.

The advantages of the scattered fraction method are: (1) Large total doses can be applied without permanent injury to the normal structures. The total dose may be from two to three erythema doses. (2) The cancer cell is hit by the rays during the most radiosensitive stage which is the time of mitoses occurring in highly undifferentiated embryonal cells about every six hours and in more mature cells about every twelve days. This is also known as the karyokinetic index of Pronst and de Nabias which is based on the ratio of the number of mitotic to the number of resting cells. The lower the index the lower is the radiosensitiveness of tumors and the more protracted the treatment should be. If the ratio is 1 mitosis to 50 to 100 resting cells then the treatment should last six days. Should the ratio be 1:100 to 1:150 the treatment should be extended to fourteen days; and should the ratio be 1:150 or less, then the treatment should last for twenty-five to thirty days. (3) Normal tissues react with a mild fibrosis, a desirable attainment as it means the production of a defensive and phagocytic tissue.

A radiation dose is the product of intensity and time. In order to correctly describe a radiation technic it is necessary to state the factors used in the application. They are: (1) location of tumor; (2) size of tumor; (3) depth of tumor; (4) strength of radioactive source; (5) distribution of radioactive source; (6) filtration; (7) distance or spacing; and (8) duration of application. To determine the location, the size and the depth of a tumor a caliper and a modified pelvimeter are used. The outline and the circumference of the body are drawn on tracing linen and the size and depth of the tumor from the anterior abdominal wall as measured with the pelvimeter are entered (see Fig. 1).

The strength of the radioactive source should be stated in milligram radium element hours or in millicurie radon hours with allowance for decay. The distribution of the radioactive source should describe the construction, the shape and the dimensions of the applicator as tube or plaque used for the application. The effective length of distribution of the radioactive material in tubes or needles should be given. The filtration should designate all of the materials interposed between the radioactive substance and the tumor including kind and thickness of the metal, rubber, leather or paraffin filters and the approximate thickness of the tissues from the surface to the tumor.

Distance is one of the most important factors in radiation therapy. It should be measured from the center of the source to the surface of the tissue or skin. In interstitial radiation it is important to state the spacing. Hence the number of needles or implants, the strength of each, the

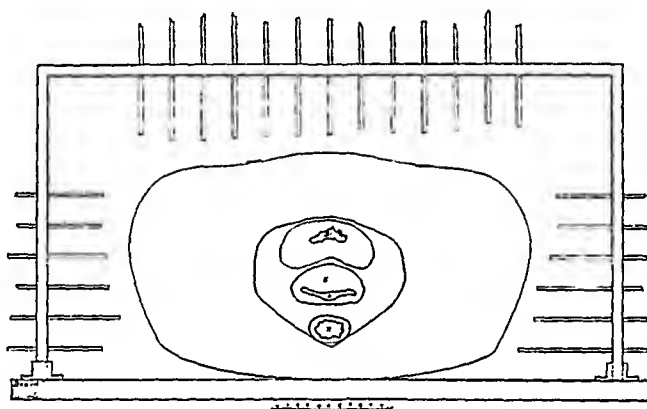


Fig. 1.—Caliper to obtain the outline of the pelvis. Location of the uterus is determined by a modified pelvimeter, one arm being straight and flexible to obtain depths and direction of uterine canal.

length of active surface, and the thickness and kind of metal container should be recorded. If cross firing be used then the location, the size of the fields and the focus skin distance should be recorded by means of a diagram. Lastly the duration of each seance with the interval between each should be given and each recorded separately. The total dosage of gamma rays *may* be expressed in milligram element hours if all the factors are otherwise given.

The factors in roentgen ray therapy include the source and type of generator and tube, the wave length, the kilovoltage, the milliamperage, the size and location of fields, filtration, the focus skin distance and the duration and date of each treatment.

The total dose should be expressed in values of E. D. or "r" units, and the time within which it is applied should be stated. If the x-rays are used, the quality of radiation as determined by the wave length should be recorded. It is not necessary to specify the wave length of radium as this is constant and equals a minimum wave length of 0.011 A. U. or

1128 K. V. according to Thibaud, and an effective wave length of 0.022 A. U. or 600 K. V.

The threshold erythema dose is defined as the amount of radiation which, if delivered in one sitting, will in 80 per cent of the cases treated produce a faint bronzing or reddening of the skin and in the other 20 per cent of the cases will produce no visible effect.<sup>14</sup> The erythema dose therefore is based on a biologic reaction namely the bronzing or reddening of the squamous cell epithelium of the skin.

The international roentgen unit "r" is the quantity of roentgen radiation which when the secondary electrons are fully utilized and the wall effect of the chamber is avoided produces in 1 c.c. of atmospheric air at 0° C. and 76 cm. mercury pressure, such a degree of conductivity that one electrostatic unit of charge is measured at saturation current.<sup>15</sup> It is purely a physical measurement. However, E. D. may be expressed in terms of r. One E. D. is 600 r measured on the body surface. The tolerance E. D. means the highest dose that may be applied to the skin in one sitting and is about 250 per cent higher than a threshold E. D.

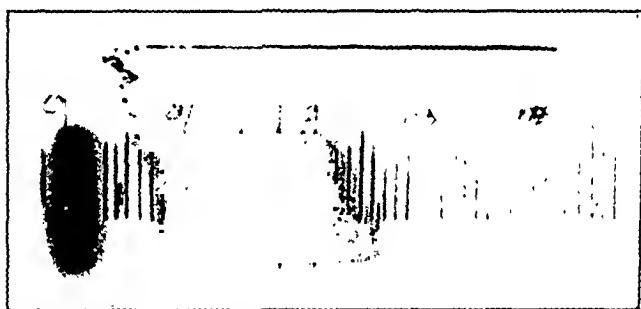


Fig. 2.—Spectrographic measurements of x-rays produced with the factors 200 K. V. and 0.75 mm. copper and 1.0 mm. aluminum filter. Shortest wave length is 0.067 A. U.; longest wave length 0.27 A. U.; average wave length 0.15 A. U.

Dosimeters standardized in r are used to determine the output of x-rays from a tube so that the time duration can be calculated within which a known amount of r may be applied.

The scattered fraction method which has been used in our clinic for about twelve years permits the application of doses that could not be made with any other technique. If one uses 200 kilovolts, a focus skin distance of 65 to 80 cm., a filter of 0.1 mm. copper plus 0.1 mm. aluminum, and a field size of 300 to 420 cm.<sup>2</sup> then one may apply a roentgen dose of 240 r every third day for 5 times, i. e. a total dose of 2.0 E. D. or 1200 r given within fifteen to eighteen days. If applied in 180 r doses then 10 times 180 r may be given within twenty-seven days. The skin will show an intense erythema after two weeks and a desquamation of the superficial layers of the skin within another eight days. The latter will heal readily within two weeks.

The gamma rays of radium have been measured by Glasser and Mautz in r units and they showed the erythema dose of gamma rays of radium to be 2000 r. Accordingly a 50 milligram element radium capsule in-

serted intracorporally into the cervical canal for 4800 mg. cl. hr. will give at a distance of 4 cm. 2500 r and at 5 cm. 1450 r. The intensities measured in r may therefore be determined by the equal intensity curves. Should the determinations of r values of gamma rays by Glasser and Mautz be correct then our values for isodoses 5 and  $2\frac{1}{2}$  will have to be corrected. Instead of 25 per cent E. D. or 500 r at isodose 2.5 the value in r would be about 667 r as 2000 r measured with gamma rays produce a full erythema dose.

The minimum wave length of radiations should always be known. Spectrometric analysis of the roentgen radiation gives the only absolute control of radiations. We use a Seeman spectrograph. Spectrographic measurements are seen in Figure 2. The minimum wave length of x-rays produced with 211 Kilovolt, 1 mm. copper and 1 mm. aluminum filter and 25 milliamperes is 0.06177 A. U. The effective wave length of the bundle of rays indicated by the shadow extends from 0.06177 to 0.26 and the average wave length of the entire bundle is at 0.12354 Angstrom Units expressed as A. U. Hence the effective wave length is about twice the minimum wave length.

If the peak voltage is known, which may be measured by a sphere gap, then the minimum wave length may be calculated by dividing the Planck constant 12.354, expressed p, with the peak voltage, designated V, i. e.  $\frac{p}{V} = \lambda$  or  $\frac{12.354}{200,000} = 0.06177$  A. U. (One A. U. =  $10^{-8}$  cm. or 0.00000001 cm.) Thus minimum wave lengths for all peak voltages can be calculated as seen in Table I.

TABLE I

THE DETERMINATION OF THE MINIMUM WAVE LENGTH IN A. U. BY THE EQUATION

$$\frac{P}{V} = \lambda \text{ IN WHICH P IS 12.354 AND V THE PEAK VOLTAGE}$$

VOLTAGE	MINIMUM WAVE LENGTH IN A. U.	EFFECTIVE WAVE LENGTH CALCULATED AS 2 X
100,000	0.12354	0.24708
200,000	0.06177	0.12354
300,000	0.04178	0.08956
400,000	0.03038	0.06076
500,000	0.02471	0.04942
600,000	0.02089	0.04178
700,000	0.01763	0.03526
800,000	0.01543	0.03086
900,000	0.01372	0.02744
1,000,000	0.01235	0.02470

#### OUTLINE OF TREATMENT

The patient enters the hospital thirty-six hours before the scheduled time of treatment. A complete blood count including differential count, blood chemistry and Wassermann test, virulency test of cervical and vaginal secretions, hydrogen ion determination of cervical and vaginal secretions, cystoscopy, and proctoscopy are done.

Blood chemistry is important to determine retention of nitrogen. Radiations should be given guardedly and controlled by subsequent nitrogen determinations if

retention is present at the first examination. Radiations cause an increase in the retention of the blood nitrogen. If this is added to a retention already existing a toxemia might ensue proving lethal to the patient.

A hemoglobin percentage of 50 or less, a red cell count of 2,500,000 or less, and a leucopenia contraindicate radiations as the existing anemia will rapidly increase from the large doses of radiations necessary for the treatment of carcinomas. In such instances an arrest of bleeding and discharge should be sought by an application of 50 mg. radium element intracervically for twenty-four to thirty hours. Should the anemia improve due to arrest of hemorrhage and septicity then a complete treatment may be carried out. Transfusions of whole blood may be necessary.

The virulency test is adapted to the technic of Phillip and Ruge. A positive reaction contraindicates all local manipulations. The infection should be combated with antiseptic douches, and roentgen radiation may be given in the meantime until a negative virulency test is obtained, when radium insertions can be safely made.

The hydrogen ion test is made from a purely investigative viewpoint. It has been stated that the  $P_n$  turns towards the acid side in the presence of carcinoma and we desire to find out how early this phenomenon may appear.

At this time the outline of the pelvis is taken with the caliper and entered on tracing cloth.

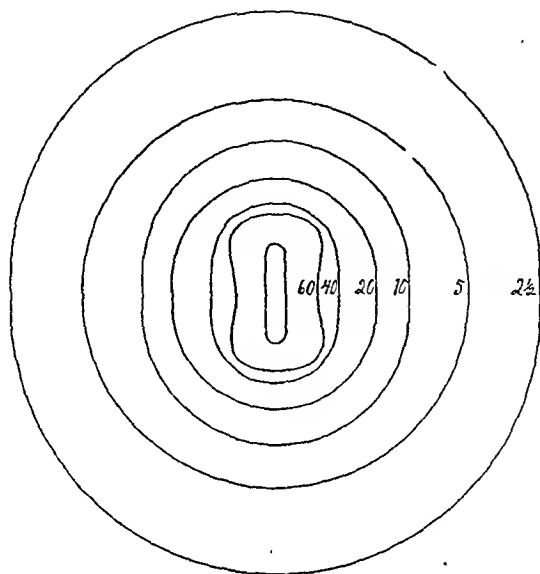
Cystoscopic and proctoscopic examinations are made routinely. Invasion of the rectal or bladder wall is a contraindication to the use of radium. However, roentgen rays may be given.

If all these tests are negative then contraindications to the insertion of radium do not exist. The patient is prepared surgically and is placed under gas anesthesia the next morning. Vaginal and bimanual examinations are again made and recorded. The position, mobility, consistency, shape and depth of the uterus, the direction of the uterine axis and the extent of the carcinoma are determined and entered on the tracing linen. Afterwards the radium equal intensity curves are entered (see Fig. 3). The linen tracing is then placed on the equal intensity curves of the roentgen rays, which are permanently cemented to a drawing board (see Fig. 4). Thereby it is possible to calculate the total radiation dose attained at any point within the pelvis. It should nowhere be higher than 4.5 E. D. throughout the radiation fields and this dose must be scattered in fractions over fifteen to thirty days.

After dilatation of the cervical canal a biopsy specimen is taken and the radium capsule containing 50 mg. element and having a wall thickness equal to 2 mm. brass placed intracervically. Firm packing pushes the bladder and the rectal mucous membranes away as far as possible. A retention catheter is placed in the bladder to keep it empty. The radium insertions are repeated twice at eight day intervals. On the intervening days roentgen ray treatments are given. The duration of treatment depends on the calculations made on the tracing (see Fig. 5). The patient is permitted to be up and about during intervals between the radiation.

The technic of radiation in carcinomas of the uterine body is as follows: The uterine cavity forms a triangle, the apex is at the internal os, the base is formed by the fundal wall. The distance from one tubal uterine os to the opposite tubal uterine os measures from 2.5 to 3 cm. The loss of intensity at a distance of 3 cm. is one-ninth of the dose attained at the radium tube. Since a tandem applicator cannot be fixed in its location within the uterine wall and may lie towards one or the other lateral walls a homogeneous dispersion of rays is problematical when using a tandem applicator. A "Y" shaped radium applicator has been constructed which permits a separation of the upper arms after it is inserted in the uterus. The set screw is marked and indicates the separation of the arms attained (see Figure 6). The equal intensity curves have been drawn in and they show that the intensity attained at the periphery of the uterus is 4 E. D. if 50 mg. of radium element are inserted in each

arm and the stem and applied for fourteen hours at eight day intervals for a total dose of 6300 mg. el. hours. Hence the distribution of the radium intensities with the Y-applicator seems to be very homogeneous and will attack the entire carcinoma with a lethal dose if the carcinoma is limited within the boundaries of the uterus.



1	2	3	4	5	6	7	8	9	10
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Fig. 3.—Equal intensity curves of 50 mg. el. radium filtered with 2 mm. brass measured in water.

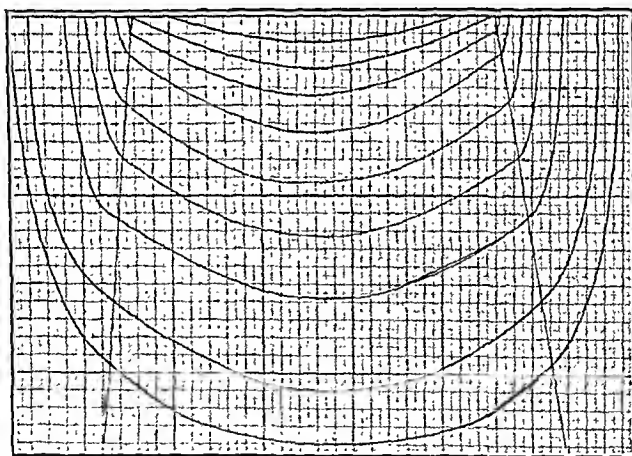


Fig. 4.—Equal intensity curves of x-rays measured in water using the factors: 211 K. V., 0.12354 A. U. effective wave length; 65 cm. focus skin distance; 1.0 mm. copper plus 1.0 mm. brass filter; 15 by 20 cm. size of field; 25 milliamperere load.

Invasion of the iliac and inguinal lymph nodes indicates roentgen irradiation. Four fields are used, namely one over each inguinal region and one over each buttocks region. The center of the pelvis is excluded from these radiations so not to cause an overradiation in the uterus, bladder, and rectum.

Radiation sickness is not frequently seen. Radiation cystitis and proctitis occur almost invariably, usually at the time the entire treatment has been concluded. They are self-limited and terminate within two to three weeks. Lithium benzoate in

10 gm. doses well diluted and given every three to four hours relieves the bladder tenesmus. Radiation proctitis is best treated with suppositories of cocoa butter and opium, and a bland diet. In very severe cases fl. extr. coto bark, bismuth subnannate and eventually deodorized tincture of opium in mistura cretae have given better results than any other medication. The skin erythema and epilation are treated with

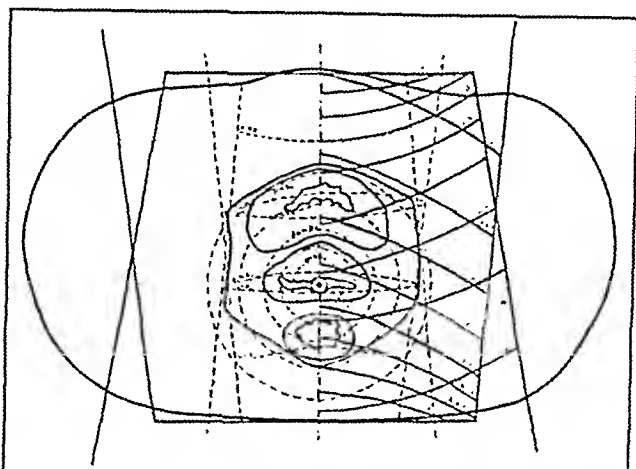


Fig. 5.—Transverse section through female pelvis just above symphysis pubis. Equal intensity curves from radium capsule placed intrauterine are drawn in circles, the radii being taken from Fig. 3. They are designated 50, 100, 200, 400, and 600 respectively which also designates the percentage of erythema doses obtained with a 4800 mg. cl. hr. application. They are drawn in interrupted lines. The equal intensity curves of roentgen rays obtained through anterior and posterior fields are drawn in solid lines in one-half of the section. The percentages in relation to the surface intensity are given as 90, 70, 50, etc.

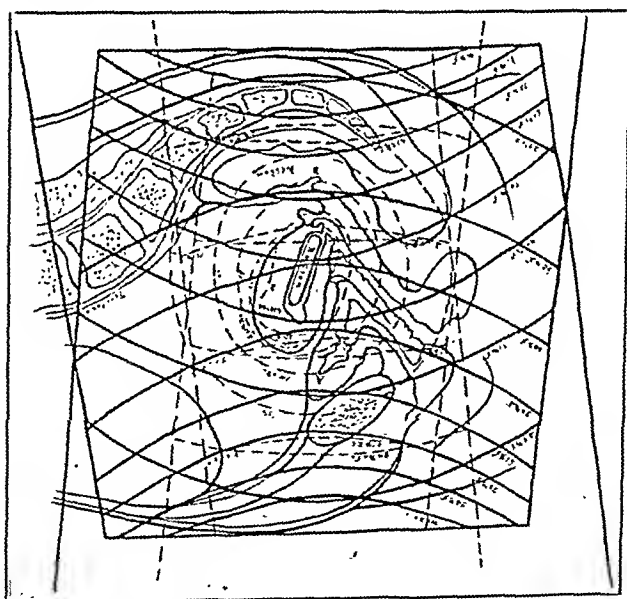


Fig. 6.—Longitudinal section through pelvis with same legends as for Fig. 5.

Dodd's lotion applied on cotton mornings and evenings. Profuse vaginal discharge reacts well to astringent douches.

The diet is a very important means of counteracting the systemic reactions due to radiation. Codliver oil, viosterol, copper and iron, milk, meats, cereals, fats are relied on. Vegetables and fruits are restricted.

Within six to twelve weeks the convalescent period should have ended and the cervix should be healed. If it has not healed we deem it unwise to repeat irradiations and rather prefer to remove the uterus if it can be done. However, should a recurrence occur after a primary healing then the ulceration is treated with interstitial radiation. Platinum needles filled with one, two or three radium cells each of 1 mg. el. strength are inserted at a spacing of 1 cm. from each other. For each estimated cubic centimeter of tissue 120 mg. hours of radium are required. It is best to place the radium needles into the periphery and not into the active growth. Otherwise it is not advisable to repeat a complete course of radiation treatment.

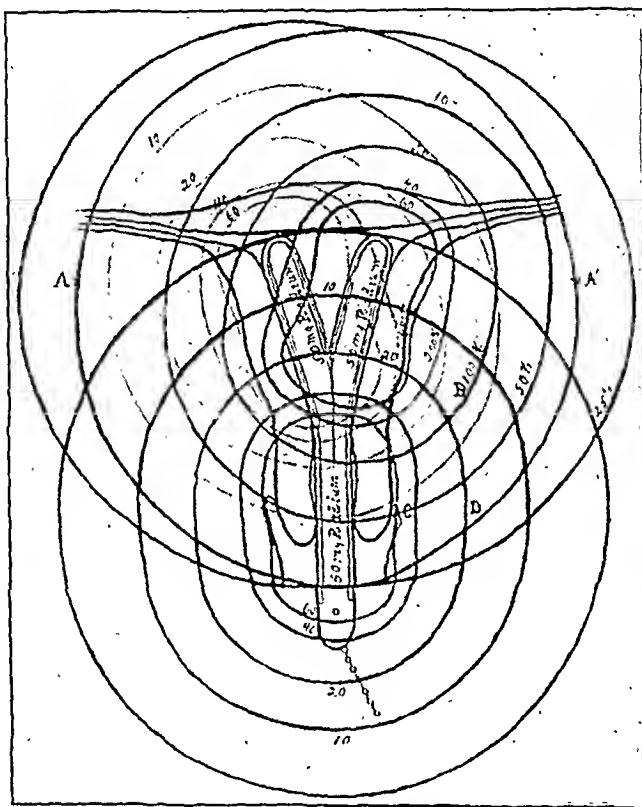


Fig. 7.—Schmitz' Y-shaped radium filter for treatment of carcinoma of the uterine body. It also makes an ideal applicator for the treatment of hemorrhagic metropathies and myomas, as the capsules are held in each uterine fundal angle and thus unintentional cauterization of the internal os is avoided.

Latent complications are stenoses of the cervical canal with pyometra. The patients complain of a mid-pelvic pain, relieved by a sudden discharge of a large amount of purulent fluid. Dilatation of the canal and insertion of a rubber T drain will relieve the complication. Lateral pain in the pelvis usually indicates compression or invasion of ureters with retention hydronephrosis. Ureteral catheterization and pyelography should be used to corroborate the clinical diagnosis. Dilatation of the ureter may cause temporary relief. In some instances in which the carcinoma had healed, resort to transplantation of the ureters was made. Several patients have thus been permanently relieved. Pressure on pelvic nerves is indicated by intense pain and often paralysis of the extremity. Repetition of the roentgen treatment may give the patient relief. Patients unable to walk on entrance to the hospital have reacted so speedily to the scattered fraction method that they left the hospital walking.

It is obvious that changes in the radiation technic were made with an improve-



TABLE II  
FACTORS USED IN ROENTGEN TREATMENT FOR EACH PERIOD TO SHOW PROGRESS  
IN DEVELOPMENT OF TECHNIC

Periods	1914 - 1919	1920 - 1921	1922 - 1923	Since 1924
Transformer	Snook Cross Arm Type		Cross Arm Type to Deliver 300 Kv.	
Type of Tube	Standard Coolidge Treatment with Broad Focus		200 Kv. Air-Cooled Coolidge	250 Kv. Water-Cooled Coolidge
Peak Kilo Voltage	110	140	211	211
Filter: Copper plus Aluminum	6 mm. Al.	0.5 mm. Cu. plus 1.0 mm. Al.	1.0 mm. Cu. plus 1.0 mm. Al.	1.0 mm. Cu. plus 1.0 mm. Al.
Focus Skin Dist.	25 cm.	65 cm.	65 cm.	80 cm.
Size of Fields	25 sq. cm.	225 sq. cm.	225 to 400 sq. cm.	225 to 400 sq. cm.
Number of Fields	8 to 20	2 to 5	2 to 5	2 to 5
Dose to Ea. Fld.	150 mamp. min.	1050 mamp. min.	1000 mamp. min.	1250 mamp. min.
Interval	8 to 20 days One fld. daily	One hr. daily 6 to 15 days	One fld. daily 2 to 5 days	5 x 250 mamp. min. Every third day to each field
Depth Dose at 10 cm.	About 20%	About 35%	44%	48%
Units in "r"			800 without Backscatter	1200 without Backscatter

ment in apparatus. Table II shows the periods and the factors for each one of the periods. In the near future a 1,000,000 kilovolt transformer and a cascade tube able to carry a load of 900 to 1000 kilovolts will be installed. The statistics presented in Table III demonstrate that the five year good end-results improved with each improvement in the roentgen technic as the radium dose has always remained the same. One may anticipate an improvement in good end-results with the use of such ultra short wave length roentgen rays, as the biologic reaction increases in direct proportion to the decrease in the wave length of the rays.

#### SUMMARY

1. The physical principles of the production of x-rays and radium should be known to obtain the best results in the treatment of malignant diseases by irradiations.

2. The methods of application, the scattered fraction method of treatment, the factors which describe the quality of the rays, the definitions of the erythema dose and the international roentgen unit, termed r, have been discussed.

3. The dose is the product of the radiation intensity and the time and

TABLE III

PERIOD: 1914 - 1919						1920 AND 1921				
Clinical Group	1	2	3	4	Total	1	2	3	4	Total
Total										
number admitted	5	16	76	35	132	9	13	26	29	77
Total 5 year										
good end-results	5	7	7	0	19	6	6	2	0	14
Per cent 5 year										
good end-results	100.0	43.75	9.21	0	14.39	66.67	46.75	7.69	0	18.38
PERIOD: 1922 AND 1923						1924 - 1927				
Clinical Group	1	2	3	4	Total	1	2	3	4	Total
Total										
number admitted	9	19	59	36	123	12	14	61	69	156
Total 5 year										
good end-results	7	7	11	0	25	10	6	16	3	35
Per cent 5 year										
good end-results	77.78	36.84	18.65	0	20.32	83	42.85	26.23	4.35	22.43
GRAND TOTAL 1914 - 1927										
Clinical Group				1.	2	3	4			Total
Total number admitted				35	62	222	169			488
Total 5 year										
good end-results				28	26	36	3			93
Per cent 5 year										
good end-results				80.0	41.94	16.36	1.72			19.14

has been given in E. D. and r. The effective wave length measured with the spectrograph gives the only absolute control of the quality of rays.

4. The use of equal intensity curves of radium and x-rays on the transverse diagram of the patient's pelvis has been demonstrated. Thereby it is possible to apply an intense radiation dose of 4 to 5 E. D. throughout the pelvis, this dose being considered lethal to the majority of uterine carcinomas. Irreparable injuries to the pelvic organs by the rays can only be avoided by the use of the equal intensity curves and the diagram.

5. The preparation of the patient, the contraindications to radiation therapy, and the treatment of local and systemic complications have been considered.

25 EAST WASHINGTON STREET.

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## AN ANALYSIS OF THE MENSTRUAL CHANGES IN TUBERCULOUS WOMEN\*

EDWIN M. JAMESON, B.S., M.D., SARANAC LAKE, N. Y.

STUDENTS of tuberculosis are constantly being reminded of the profound alterations in the physiology of unrelated organs and systems which are brought about by the presence of an active tuberculous process in the lungs, intestines, or elsewhere. Pulmonary tuberculosis especially can no longer be regarded as a disease of the lungs alone but rather as a systemic condition whose presence is reflected in every tissue of the body.

The pathologic physiology of the gastrointestinal tract, the blood, the nervous and circulatory systems in patients suffering from tuberculosis has been well worked out and numerous studies have been made on the blood pressure variations and basal metabolic rates, but in no system, perhaps, are the changes so manifest as those found in the physiology of the female genital tract. Other investigations of these changes have been made, notably by Norris and Maelt, but none, so far as we have been able to determine, from the same angle as that which follows.

This report is based upon an analysis of 200 detailed menstrual histories obtained consecutively from women at the sanatoria in and around Saranac Lake. All of these patients have active pulmonary tuberculosis; 22 have intestinal, 3 laryngeal, and one cervical gland lesions in addition. The ages vary from sixteen to forty-eight, with the largest group falling in the third decade of life. With the exception of minor treatment for leucorrhea and a few instances of enuretage, none of the patients in this series had had operations on the genitalia.

While it is appreciated that this series is small and that there are far too few cases in the various groups when the subdivisions have been made to warrant any definite conclusions, this report would seem to be of interest for the purpose of demonstrating trends rather than that of actual figures or percentages.

An analysis of the age groups shows 13 in the sixteen to twenty group; 125 between twenty and thirty; 47 between thirty and forty, and 15 over forty years of age. The group over forty is small because of the confusion which may arise with symptoms of the menopause. On the basis of extent of disease according to the National Tuberculosis Association classification, there were 34 minimal, 114 moderately advanced, and 52 far advanced cases.

The age of puberty was thirteen and four-tenths years for the minimal cases; twelve and eight-tenths years for the moderately advanced, and thirteen and nine-tenths years for the far advanced patients. This is

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\*Read, by invitation, at a meeting of the New York Obstetrical Society, March 8, 1932.

unexplained as the average age for the various groups is practically identical (twenty-seven and five-tenths years).

In answer to the question, "Have you noticed any change in your menses since beginning the cure?" 55.8 per cent of the minimals, 58 per cent of the moderately advanced, and 67.3 per cent of the far advanced cases answered in the affirmative. All of these changes were not for the worse as an appreciable number reported a return to a twenty-eight-day interval or improved flow, since entering the sanatorium. When calculated on the basis of age groups, 55 per cent of the girls under thirty showed changes since the onset of tuberculosis and 68 per cent of the patients over thirty. This latter increase is not due to the approaching menopause as the percentage is the same for the fourth and fifth decade groups separately.

Previous to the onset of tuberculosis 20 per cent of the entire series gave a history of irregularity; since the diagnosis of tuberculosis has been made 26 per cent have been irregular. The extent of the disease seems to have but little influence on the incidence of irregularity as shown in Table I.

Sixteen and one-half per cent of the series have had longer inter-

TABLE I. IRREGULARITY

	BEFORE TUBERCULOSIS	SINCE TUBERCULOSIS
Minimal	20.6%	29.4%
Moderately Advanced	17.5%	23.6%
Far Advanced	25 %	29 %
Total	20 %	26 %

menstrual periods since the onset of tuberculosis while 18 per cent report shorter intervals and 66.9 per cent no change. As shown in Table II, the minimal cases show the greatest incidence of change and the incidence of longer or shorter intervals is very similar for all groups.

The average number of days of flow for all groups is four and nine-tenths before the onset of tuberculosis; four and six-tenths days since. The minimal cases decreased on the average from five to four and six-tenths days; the moderately advanced from five and one-tenth to five; and the far advanced from four and eight-tenths to four and three-tenths days. We are unable to explain the discrepancy in the moderately advanced group.

A history of flow lasting more than six days, exclusive of puberty or miscarriages, was given by 20.5 per cent of the minimal, 18.4 per cent of the moderately advanced, and 11.5 per cent of the far advanced cases. This makes an average figure of 16.8 per cent for the entire series and suggests that hypermenorrhea becomes less common as the disease progresses.

Taking a history of one or more periods skipped (exclusive of the

first years after puberty, pregnancy, and operated cases) as a criterion, 13 per cent of the minimal cases, 27 per cent of the moderately advanced, and 26 per cent of the far advanced cases had had periods of amenorrhea. These figures are strikingly high when compared with those of Norris. It is our impression that the onset of the disease or an increase

TABLE II. LENGTH OF INTERMENSTRUAL PERIOD

	LONGER	SHORTER	NO CHANGE
Minimal	23.5%	20.6%	66 %
Moderately Advanced	15 %	17 %	68 %
Far Advanced	15.6%	17.6%	66.8%
Total	16.5%	18 %	66.9%

in the lesion is the commonest time for the appearance of amenorrhea and that, while the incidence in the moderately advanced and far ad-



Fig. 1.

vanced groups is the same, when once established it tends to last longer in the far advanced cases. That age is also a factor is evident when we see that the incidence in patients below thirty is 18.8 per cent while for those over thirty it is 32 per cent in each decade.

Of similar interest was the history of intermenstrual bleeding, exclusive of miscarriages, since the onset of tuberculosis. In the minimal group, there were 4 cases; in the moderately advanced 7, and in the far advanced group 3 patients with a history of metrorrhagia since coming to the sanatorium. The incidence for the entire series is 7 per cent with a frequency twice as great in the minimal cases as in the other two groups.

We have had occasion to enrette a number of these cases of metrorrhagia in tuberculous women with the hope of making a diagnosis of the cause. The findings have been very confusing as the microscopic picture varies from that of an apparently normal resting endometrium through that of the different cyclic changes. A few cases of undoubted endome-

trial hyperplasia have been encountered but in a large proportion of cases the pathologist was unable to solve the question of why bleeding occurred (Figs. 1 and 2).

The differences in the amount of flow for each group since the onset of tuberculosis is shown in Table III. It will be seen that there is a greater tendency to no change or a decrease than towards more flow in all the groups.

Dysmenorrhea would seem to be a common complaint, although Tobler and Schaffer find that 70 to 75 per cent of otherwise normal women suffer more or less at the time of flow. This series shows a slight increase in the total number of cases of dysmenorrhea in each group since the onset of tuberculosis, but a significant rise in the number of severe cases. Table IV shows the type of dysmenorrhea. The percentages are figured on the total number of cases of dysmenorrhea in each class of



Fig. 2.

tuberculous lesion rather than upon the entire group. Calculated on the basis of the entire series, 68 per cent of the tuberculous women had dysmenorrhea divided as follows: 18.3 per cent congestive type, 53 per cent obstructive, 28.6 per cent mixed, and one case of postflow pain in a

TABLE III. AMOUNT OF FLOW

	UNCHANGED	MORE	LESS
Minimal	67.7%	14.7%	17.6%
Moderately Advanced	81.7%	6.1%	12.2%
Far Advanced	69 %	5.7%	25 %

TABLE IV. TYPE OF DYSMENORRHEA

EXTENT OF DISEASE	PREMENSTRUAL	MENSTRUAL	MIXED
Minimal	29.0%	50 %	28 %
Moderately Advanced	16.0%	55.5%	28.4%
Far Advanced	16.0%	48.4%	35.5%
Total	18.3%	53.0%	28.6%

single girl whose menses lasted three to four days and whose pain appeared on the fifth day. As only nine girls in the entire series weighed less than one hundred pounds (five of whom had no dysmenorrhea and the remainder no more or no less than they had before the onset of tuberculous), the theory of malnutrition as a cause of menstrual pain in tuberculous women does not seem tenable.

Additional data on the question of dysmenorrhea is given in Table V where the pain is classified as mild, moderate, or severe. This is an arbitrary grouping and depends upon the patient's own reaction to her pain. The table also shows that about 10 per cent of the girls have less pain than they had before and a somewhat larger number more.

Symptoms other than pain noted by these women are shown in Table VI. While no figures are at hand to support the contention, we believe that an equal number of so-called normal women would show about the same results with the exception of the large number who complained of prostration and premenstrual, menstrual and postmenstrual elevations of temperature. In this study premenstrual and menstrual fever was taken to be 99° F. or over, while in a previous analysis, somewhat more accurate criteria were followed and a lower incidence discovered. It is our impression that the menstrual elevations of tempera-

TABLE V. DYSMENORRHEA

	MINIMAL	MODERATELY ADVANCED	FAR ADVANCED
None	32.3%	32.4%	44.2%
Mild	8.8%	24.5%	17.3%
Moderate	32.3%	24.5%	17.3%
Severe	26.4%	18.4%	21.1%
Less Since Onset	11.7%	10.5%	10.0%
More Since Onset	17.6%	12.2%	12.0%

TABLE VI. NUMBER OF CASES SHOWING SYMPTOMS OTHER THAN PAIN

SYMPTOM	MINIMAL	MODERATELY ADVANCED	FAR ADVANCED	TOTAL
Distention	0	0	1	1
Diarrhea	0	2	0	2
Sore Breasts	0	4	0	4
Nausea	1	3	2	6
Headache	6	19	4	29
Fatigue	3	6	1	10
Vomiting	0	3	1	4
Weakness	0	2	0	2
Irritable	2	2	1	5
Syncope	0	0	1	1
Epistaxis	0	0	1	1
Nervousness	2	2	3	7
Vertigo	1	0	0	1
Hysterical	0	0	1	1
Prostration	5	29	17	51
Premenstrual* Fever	58.8%	55.2%	59.6%	57.0%
Menstrual Fever	14.7%	7.8%	7.6%	9.0%
Postmenstrual Fever	5.9%	4.8%	3.8%	4.5%

\*Premenstrual, menstrual, and postmenstrual fever is 99° F. or over.

ture occur in patients who are not doing well. The postmenstrual fever shown by the minimal cases was a continuation of the premenstrual and menstrual elevations; the same condition holds in the moderately advanced and in addition half the cases were progressing. In the far advanced group both cases had intestinal tuberculosis and one, in addition, who had a tuberculous larynx had chills and a temperature of 102 to 104° F. on the first day after the menstrual period.

The question of leucorrhea was studied in single women only and an incidence of 41 per cent for the entire group noted. It was contrary to our expectations to find the highest incidence among the minimal cases and the lowest among the far advanced. The details are shown in Table VII.

It is interesting to note that there is less leucorrhea among the tuberculous women who are popularly supposed to be "run down" than occurred before they became ill. An intermittent leucorrhea is the more frequent type in all the groups, but there are proportionately more cases of a constant discharge in the minimal cases than in those that are advanced. Similarly all the positive cases in the far advanced group had a scant discharge only, while 18 per cent of the minimals described it as profuse.

We were unable to show any definite relation between pregnancy and onset of tuberculosis in this series. Sixty married women have been included, of whom 34 have been pregnant. Twenty-seven went to term one or more times. Two patients dated the onset of their tuberculosis to

TABLE VII. LEUCORRHEA (SINGLE WOMEN ONLY)

TYPE	MINIMAL	MODERATELY ADVANCED	FAR ADVANCED	BEFORE TUBERCULOSIS	SINCE TUBERCULOSIS
Incidence	44.0%	38.2%	41.0%	46.0%	41.0%
Intermittent	72.7%	80.0%	85.0%	88.0%	79.2%
At Menses Only	18.0%	62.5%	33.0%	38.6%	37.8%
Constant	27.2%	20.0%	15.0%	12.0%	20.7%
Slight	81.0%	90.0%	100.0%	96.0%	90.0%
Profuse	18.0%	10.0%	0	4.0%	10.0%

abortions, and one moderately advanced case had a therapeutic abortion done after the diagnosis was made. One far advanced case, who has had tuberculosis for fifteen years, has had two babies, the last three years ago, and one miscarriage seven years ago. One moderately advanced patient, para ii, dated the onset of her tuberculosis to the time of her last confinement but the evidence is not conclusive and another moderately advanced case had a confinement six months before her tuberculosis was diagnosed. The remainder showed no relation whatsoever.

Intestinal tuberculosis was present in 22 patients, but this complication seems to have no influence on the incidence of changes in their menses since beginning the antituberculous régime as compared with the entire group.



Of the 80 girls who gave a history of hemoptysis, an incidence of 40 per cent for the series, 26 per cent reported the occurrence of pulmonary hemorrhages only at the time the menses were present; 53.7 per cent between periods; 10 per cent showed no relation, and 10 per cent could not recall whether or not they were menstruating at the time. Thus, while hemoptysis did occur in 26 per cent of the cases at the time of catamenia, a cause and effect relation is not clear except in the occasional case. One minimal case, a section of whose endometrium is shown in Fig. 1, "streaked" daily over a period of three and a half months, while we were endeavoring to stop her metrorrhagia with small doses of x-ray. Radium was finally used and when the uterine bleeding was stopped the pulmonary hemorrhages also ceased and have not recurred.

The number of patients in this series who were taking pneumothorax is too small to warrant a detailed analysis but the findings have been of sufficient interest to stimulate the further study which is now in progress. Suffice it that in a large percentage of cases the effects of collapse therapy appear to have a deleterious influence on the menstruation and only a few show the improvement noted by Caussimon.

#### CONCLUSIONS

No attempt can be made to draw up a list of definite conclusions from such a series as is presented in this report, but the necessity of revising many of our former ideas of the influence of tuberculosis on the menses is apparent. Particularly is this true of the questions of amenorrhea and the influence of collapse therapy on the menses. Whether or not menstruation, with the coincident lowering of capillary permeability, predisposes to hemoptysis is a fruitful field for further study and holds many possibilities. Certainly it is true however that tuberculosis exerts a profound effect through some as yet undetermined mechanism upon the menstrual cycle and that we are only beginning to appreciate its true extent.

The author wishes to express his thanks to Drs. Helen Evarts and John Booth, without whose assistance this report would not have been possible.

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6 CHURCH STREET.

#### DISCUSSION

DR. M. D. MAYER.—It seems to me that in the fairly advanced cases, especially in the third decade of life, it would be rational to advise routine radiation of the ovaries in order to give at least a one- or two-year complete amenorrhea. It is almost impossible in the first half at least of the third decade and at least unlikely in the second half of the third decade, to produce a permanent amenorrhea with the pieceable doses of x-ray. In a fairly large series of therapeutic

abortions for tuberculosis, produced by means of x-ray, it has been found that the large majority of cases do very well clinically as far as their tuberculosis is concerned after the incidental long-term amenorrhea which occurs after the abortion has taken place.

DR. HARVEY B. MATTHEWS.—I believe it can be safely said that our conception of menstruation, pregnancy, and labor in relation to tuberculosis, will have to be more or less revamped.

It may be in order to suggest that these menstrual disturbances could be brought about by at least three different pathologic conditions, First, the tuberculosis itself; the constitutional change brought about by the tuberculosis in any of its forms, but more particularly the pulmonary type, may have something to do with these changes, because these girls do improve during an amenorrhea; second, the endocrine disturbances that we know go with tuberculosis, particularly pulmonary tuberculosis, may have, and undoubtedly do have considerable influence on these changes; and third, changes in the blood chemistry may have something to do with these, since we know that the calcium content of the blood in tuberculosis is lowered, as it is during the menstrual and postmenstrual periods. So if the calcium coefficient is lowered in general tuberculosis, a constitutional disease, then it is lowered further during the time of the menstrual flux. It would naturally, therefore, be supposed that there would be an exacerbation of the tuberculous process during the menstrual period. That is shown by the rise in temperature in 42 per cent. I believed this percentage was much higher.

Formerly at Saranac Lake there was a good deal of opposition to the idea of an irradiation amenorrhea. There were quite a few patients who were suffering from hemorrhages of various kinds and who also had severe dysmenorrhea. I suggested producing amenorrhea with radium, but the idea was not received favorably. However, several patients were irradiated and in every instance there was improvement in the tuberculosis. I would recommend a temporary amenorrhea in suitable cases. The "dosage" of radium can now be fairly definitely controlled, and I can see no harm in its use and I have seen much benefit accrue to the tuberculosis. We have accumulated enough data to be fairly certain that preconception irradiation is a perfectly safe procedure as regards future pregnancy.

DR. JAMESON (closing).—We got the idea of inducing amenorrhea in pulmonary tuberculosis from German authorities, but the local ultra-conservative group would not let us do it. I have had about six cases and all of them were improved. I talked to some of the girls, particularly at Stony Wold, and they said they would be glad to have their menstruation cut out because they all felt very much worse at the time of their periods; and I believe I am correct in insisting that the lung findings are always more marked at the time of menstruation than at any other time.

As regards calcium metabolism, the work done at Stony Wold on the nondiffusible-diffusible ratio in the blood and spinal fluid, was found of no value in determining activity or prognosis.

I am firmly convinced that these girls, who have a fever during the menstrual period, should have an amenorrhea established: it does not matter whether it is permanent or not in that case. Some men think the temperature during menstruation indicates a blood stream infection with tubercle bacilli, and the Germans and French claim that they have obtained tubercle bacilli from the blood stream. Several attempts have been made at Trudeauau, but were unsuccessful in finding the tubercle bacillus in the blood stream.

## EPITHELIAL REGENERATION IN THE UTERINE GLANDS AND ON THE SURFACE OF THE UTERUS\*

GEORGE N. PAPANICOLAOU, M.D., PH.D., NEW YORK

*(From the Department of Anatomy, Cornell University Medical College)*

ONE of the characteristics of the uterine epithelium is its periodic destruction and regeneration. The periodic loss of the epithelium occurs during menstruation in the human being and in the primates and during estrus in the lower mammals. This reaction shows great variations in the various types of mammals and in different individuals. In women, according to some investigators, only a small part of the epithelium and of the underlying stroma is cast off. According to others, the whole epithelium and a large part of the tunica propria, at least the whole of the compacta and most of the spongiosa, are eliminated. The last view can hardly be considered applicable to the average normal type.

The regeneration of the uterine epithelium occurs with surprising rapidity. In guinea pigs, a complete replacement of the epithelium is found within a few hours after its desquamation. In women, the regenerative processes begin as early as the third day of menstruation<sup>1</sup> and develop very rapidly. Another surprising fact is the almost complete absence of mitotic figures during this early regenerative stage. The actual proliferative phase, during which a large number of mitoses can be seen, occurs later, when the new epithelium is almost completely formed. These two facts, i. e., the rapidity of the new epithelization and the lack of mitotic figures, cannot be well explained by the generally accepted theory, that the uterine epithelium regenerates from the epithelium of the deep glands which has escaped destruction, or from remnants of the old epithelium.

In 1890, Duval,<sup>2</sup> and later Johnstone,<sup>3</sup> and Heape,<sup>4</sup> expressed the view that at least a part of the uterine epithelium regenerates in a different way, by the actual differentiation of the superficial cells of the tunica propria. Duval pointed out that, since the uterine epithelium, as well as the tunica propria, were both of mesodermic origin, it was not inconceivable that such epithelium could be formed by a transformation of mesodermic cells.

More than ten years ago, in studying the uteri of guinea pigs, killed at different times after copulation, I noticed that, in several specimens, the new uterine epithelium looked as if it were suddenly arising through a differentiation of the most superficial cell layers of the tunica propria. Being out of accord with such an interpretation on theoretical grounds

\*Read, by invitation, at a meeting of the New York Obstetrical Society, March 8, 1932.

and realizing that the evidence offered by this material was insufficient, I did not continue the observations. Recently, however, in studying the epithelium of uterine glands, I have been impressed by the fact that the epithelium in these glands is desquamated to the very tip of the gland and then a process of regeneration of an entirely new glandular epithelium quickly ensues. The changes within the glands did not appear

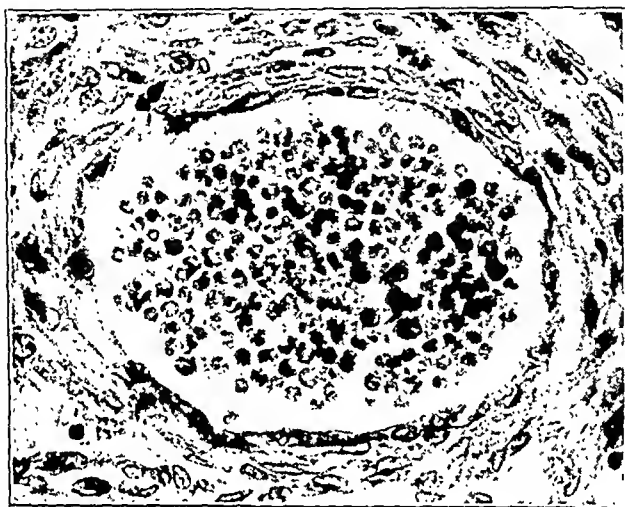


Fig. 1.

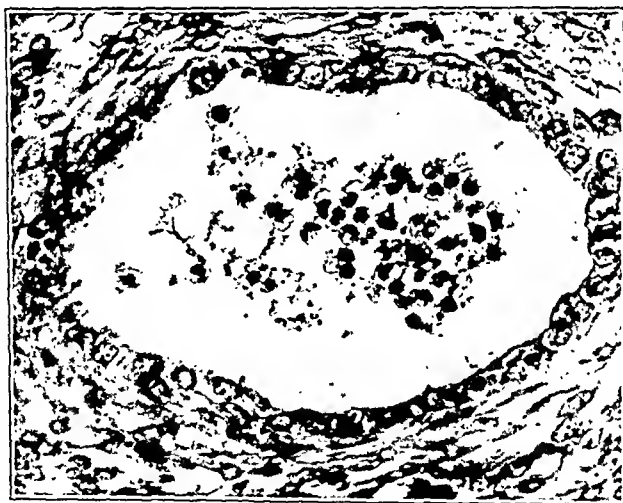


Fig. 2.

to be synchronous with the changes on the surface of the uterus, and this may have been the reason why they escaped the attention of previous investigators.

The desquamative and regenerative processes in the glands are much simpler and they clearly indicate that the new epithelium is formed by the actual differentiation of the superficial cells of the tunica propria.

One may recognize a series of stages succeeding one another in a typical fashion. First, there is a stage of desquamation, during which the epithelium disintegrates and falls into the lumen of the gland, which is soon filled with a large number of desquamated cells and leucocytes (Fig. 1).

The next stage is characterized by the gradual differentiation of the superficial cells of the tunica propria. These cells are small and have a round or slightly elongated, oval, or elliptic nucleus and a very small amount of cytoplasm (Fig. 1). They resemble undifferentiated embryonic cells and are very abundant within the tunica propria. Their nature has been the subject of a great deal of controversy. We adhere to Minot's view considering them to be embryonic in character. These cells become rounded and gradually form a continuous lining on the surface of the naked gland (Fig. 2).

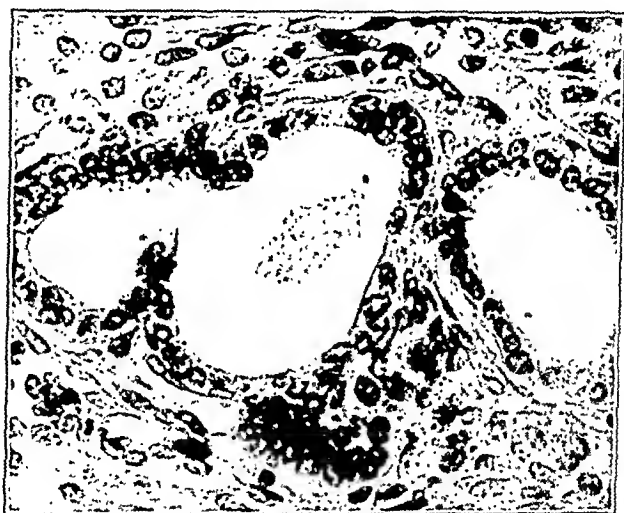


Fig. 3.

A period of growth now follows during which these cells, as well as their nuclei, become larger and display a progressive differentiation from a round to a cuboidal form (Fig. 3). In continuation of this, an extensive proliferation is initiated during which a large number of mitoses can be seen (Fig. 4). The mitoses appear, en masse, when the new epithelium is totally differentiated and are more numerous near the surface. They evidently represent an active proliferation of the newly formed epithelium.

Similar changes and a corresponding succession of stages occur at the surface of the uterus. In typical cases the whole of the uterine epithelium is cast off (Fig. 5). Below this, a basement membrane is often seen connected with cells resembling fibroblasts. Such a membrane appears also in the glands and is usually cast off with the epithelium. The superficial undifferentiated cells of the uterine wall are now grouped

together in a heavy, compact zone which reminds one of the compacta, as it has been described in the human being during premenstruum and menstruation (Fig. 5). Hitschmann and Adler<sup>5</sup> and others, who described this zone, considered it as a differentiation of a false decidua. In the light of the present investigation, it seems to represent a heavy accumulation of undifferentiated cells near the surface of the uterus as a preparation for the formation of the new epithelial lining.

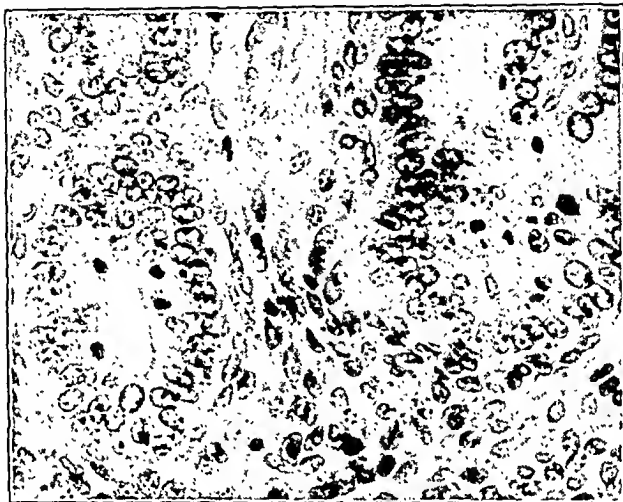


Fig. 4.



Fig. 5.

Soon after this the growth phenomena are initiated. The most superficial cells become rounded, larger in size, and form a continuous epithelial layer (Figs. 6 and 7). This new epithelium is gradually separated from the underlying undifferentiated tissue and takes on a cuboidal form. The proliferative phenomena appear after the new epithelium is already formed (Fig. 8). The mitotic figures are numerous and usually located near the surface of the epithelium, as in the glands. It is thus

evident that the restoration of the epithelium occurs before the appearance of typical proliferative phenomena.

The existence of cyclic changes in the epithelium of the uterine glands is of particular interest, because it provides new material for the study of the uterine epithelial regeneration. The changes occurring on the surface of the uterus are very complex and atypical due to several disturbing factors. One of these is the extreme abundance of glandular



Fig. 6.

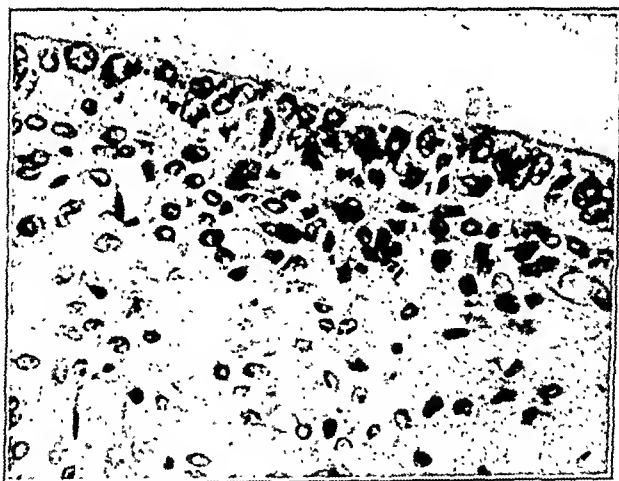


Fig. 7.

ducts ending very close one to another on the surface of the uterus. When the new epithelium is formed, it is almost impossible to decide whether the regeneration began on the surface of the uterus, within the glands or simultaneously in both. It is often possible to interpret the same figure in three different ways, without definite proof of the correctness of any. This disturbing factor does not exist in the deep glands. When the epithelium is desquamated from an entire gland, there is practically no trace of old epithelium left to account for the sudden reappearance of a new epithelial lining.

Another confusing factor is the often extensive destruction of large pieces of tunica propria on the surface of the uterus along with its epithelium. This creates an irregular healing surface, greatly complicating the simplicity of the new epithelial differentiation. In the glands it is only the epithelium and the basement membrane that are cast off, the tunica propria remaining almost intact.

Groups of glands undergoing epithelial replacement are easily recognized by the large number of leucocytes and cellular detriment, filling their lumen. Confusion with glands undergoing cystic degeneration is practically impossible, because of the characteristic structure of their epithelium.

These studies favor the view that the tunica propria of the uterus contains a large number of undifferentiated cells of mesodermic origin,

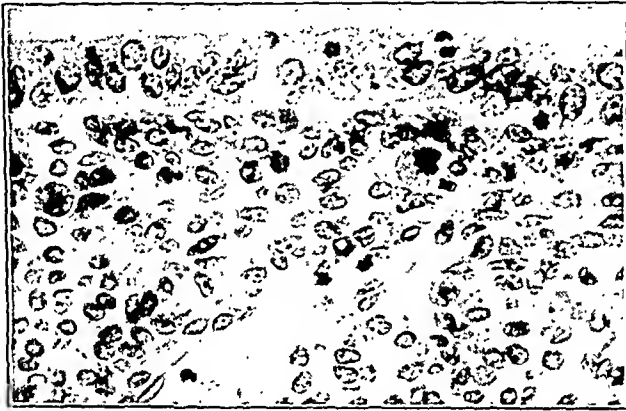


Fig. 8.

which, under favorable conditions, may form epithelial tissue. This occurs on the surface of the uterus, soon after the old epithelium is cast off and also within the deep uterine glands. The new epithelium is completely formed within a very short time. Growth and proliferative phenomena appear later. The replacement of the epithelium within the uterine glands is a much simpler process than the replacement of the epithelium on the surface of the uterus and offers excellent material for an accurate study of this problem.

NOTE: This work has been aided by the Committee for Research on Sex Problems of the National Research Council.

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#### DISCUSSION

DR. J. A. CORSCADEN.—Is it fair to say that the connective tissue elements of the endometrium can become epithelial because they are of the same mesoblastic origin?



DR. G. N. PAPANICOLAOU.—The uterine epithelium is evidently formed by undifferentiated, embryonic cells present within the tunica propria and not by differentiated connective tissue elements. The fact that the epithelium as well as the tunica propria of the uterus are both of mesodermic origin permits us to approve of such an interpretation from an embryologic point of view.

DR. W. H. CARY.—I would like to know what relationship this might bear practically and clinically to the traumatism of too deep curettement; whether destruction brought about by curetting could interfere with the regeneration of the uterine epithelium.

DR. G. N. PAPANICOLAOU.—We suppose that the regeneration of the uterine epithelium after curettage occurs in the same way as normally, i. e., by a differentiation of embryonic tunica propria cells. We do not believe that destruction brought about by a mild curetting would interfere with the regeneration of the uterine epithelium, since numerous regenerative cells are scattered through the whole of the uterine mucosa. Of course a very deep curettement might cause a certain damage by destroying too much of the regenerative reserve cell material.

DR. W. H. CARY.—I am referring to curettage for hemorrhage in cases of incomplete abortion, whether damage could be done where it is carried down to the muscle, if the destruction could be such as to interfere with regeneration of the uterine epithelium.

DR. G. N. PAPANICOLAOU.—Our discussion on the regeneration of the uterine epithelium after curettage is purely theoretical, as we have not undertaken experimental work along this line. From a theoretical standpoint we would be inclined to believe that a very severe curettement carried down to the muscularis would cause permanent injury to the uterine epithelial wall and to its regenerative ability.

DR. MAYER.—Am I right in assuming that Dr. Papanicolaou has found exactly the same pictures in human uteri as in guinea pigs?

DR. G. N. PAPANICOLAOU.—No. We have not had the opportunity to extend these observations to human uteri. The regenerative changes within the uterine glands have been found by us only recently in guinea pigs. Whether similar changes occur in the human we cannot definitely state. We find a suggestion of such changes in some of the photographs published by other investigators in the human being.

The fact that the uterine glands during the very early stages of the epithelial replacement are filled with dead desquamated cells and phagocytes helps greatly in their identification even with a low power.

DR. G. L. MOENCH.—I would like to ask Dr. Papanicolaou if he has seen any similar epithelial changes in the peritoneum. This membrane, lining the celom formed by the splitting of the mesoderm into the splanchnopleure and somatopleure, is of pure mesodermal origin, yet in the woman at times typical endometrial glands seem to originate from it. Some of us consider the peritoneum to be the source of many adenomyotic processes.

DR. G. N. PAPANICOLAOU.—I recall only one case in which uterine glands were present within the myometrium in a guinea pig. The uterus was highly cystic and the uterine wall greatly distended. The uterine mucosa was very thin. One could gather the impression that this invasion of mucosal elements within the muscularis was an abnormal condition caused by the action of degenerative factors. Otherwise, I have not observed uterine gland inclusions within the myometrium in normal animals. It is difficult to offer any general interpretation for these peculiar morphologic discrepancies.

DR. G. L. MOENCH.—What do you consider the stroma itself, outside of the mesoderm?

DR. G. N. PAPANICOLAOU.—In the light of these investigations the tunica propria of the uterus seems to consist of two distinct groups of cells: some differentiated connective tissue elements and some undifferentiated embryonic cells. The presence of the last group gives a peculiar structure to the uterine mucosa and secures a rich supply of regenerative reserve material. For an organ undergoing repeated and extensive epithelial destructions, as the uterus does, this seems to represent a very well adapted morphologic structure. The same reserve material may be used for another useful purpose, i. e., the differentiation into decidual tissue.

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## THE BEHAVIOR OF THE EPITHELIUM IN EXPLANTS OF HUMAN ENDOMETRIUM\*

EDWIN F. HIRSCH, M.D., AND HAROLD O. JONES, M.D., CHICAGO, ILL.

(From the Henry Baird Favill Laboratory and the Department of Gynecology, St. Luke's Hospital)

EXPLANTS of human endometrium have been cultured for various purposes. In experiments concerned mainly with the growth in vitro of human malignant tumor tissues, they have been cultured incidentally; in other experiments, they have been explanted with the purpose of testing Sampson's theory of displaced endometrial tissue growth; and finally in studies chiefly of an academic nature, endometrial tissues have been cultured to see what cellular structures, if any, grow.

Cron and Gey<sup>1</sup> cultured endometrium recovered on the second day of menstruation in a plasma medium containing heterologous embryonic extract. After several hours' incubation, they noted an activity of the cells and, for several days, a growth of leucocytes far into the medium. The fixed tissue cells began to emigrate on the second day, when radial outgrowths of spindle cells and sheets of epithelium appeared at the periphery of the tissue fragments. The explants were transferred every four or five days for a month. Although these explants had vital properties, they were discarded because the tissue masses did not increase in size. Cron and Gey concluded that they had demonstrated viability of endometrial tissues removed by curette. Their cultures were not sectioned serially. Heim<sup>2</sup> cultured endometrium in a mixture of female human and chicken plasmas and chick embryo extracts. He reported the growth of a variety of cells, but his statements regarding the nature of the tissue cells growing about his explants are vague. Fragments of endometrium obtained by curette were cultured by Caffier<sup>3</sup> on homologous and heterologous plasma containing embryonic tissue extracts or other fluids. None of these mediums consistently promoted growth: Caffier preserved the vitality of his explants only fourteen days. His explants were stained in toto. He described membranes of cells around the explants, but the character of the cells participating in this growth was not mentioned. Traut,<sup>4</sup> with a fibrinogen solution and diluted embryonic extract containing a trace of sodium linolate, maintained the growth of human endometrial explants about twenty days. His cultures were fixed, stained, and mounted in toto. The growth of new tissue, he stated, was entirely of the stroma or connective tissue portions of the explant; the epithelium, having a long latent period, was overgrown by the stroma cells. Conclusions based only on the microscopic examinations of living explants or even preparations stained in toto are hazardous. None of the authors

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\*This research was aided by a grant from the Watson K. Blair Fund.

reported the study of explanted endometrium in serial sections, a method now considered necessary.

Accordingly to generally accepted histologic descriptions<sup>2</sup> the lamina propria of the endometrium is a network of reticular fibers condensed into a basement membrane under the epithelium of the surface and glands. This fibrous reticulum is intimately connected with many small polyhedral cells having small processes that anastomose throughout the tissues and adhere to the fibers of the reticulum. The small spaces between the cells contain wandering cells such as lymphocytes or granu-



Fig. 1.—An explant four days old with focal regions of necrotic stroma. There is only a slight hyperplasia of the glandular structures.  $\times 270$ .



Fig. 2.—Photomicrograph of an explant seven days old. Considerable of the stroma is necrotic. There is a moderate hyperplasia of the surface and glandular epithelium.  $\times 270$ .

lar leucocytes. In the deeper layers of the mucosa these cells may be numerous. An abundant supply of capillaries is distributed in networks under the surface epithelium and around the glands. The uterine glands are simple tubules lined by ciliated columnar epithelium. The variations during menstruation have been analyzed and described by Bartelmez.<sup>4</sup>

A study was undertaken to determine in serial sections the behavior of human endometrium explanted into a medium composed of human tissue fluids and to note especially any changes of the epithelium.

Uteri removed in the operating rooms were sent sterile to the laboratory and were kept for convenience at body temperature in an incubator not longer than one to three hours. Thin pieces of endometrium of 2 to 4 sq. mm. surface area then were explanted into a medium composed equally of heparinized (1:10,000) plasma obtained from postpartum women and tissue extract made by crushing endometrium in Tyrode's solution. The cover glass method of tissue culture described by Maximow<sup>7</sup> was used. The explants were transferred into fresh medium at intervals of one to three days. Certain cultures were useless because of contamination or failure to grow. The rapid liquefaction of the medium about the explants and the fragmentation of the newly-grown tissue cells in the liquefied medium were further difficulties encountered. Seven sets of cultures were endometrial explants from women twenty to thirty years of age; sixteen were from women thirty to forty years of age; eight were from women forty to fifty years of age; and one was from a woman sixty-five years of age.



Fig. 3.—Photomicrograph of an explant fourteen days old illustrating the marked necrosis of the stroma tissues, the hyperplasia of the epithelium, and its orderly relation with the stroma.  $\times 270$ .

Within twenty-four hours, as a rule, the medium about the explants was liquefied and a growth of tissue cells mainly of the polyblasts or lymphocytes of the stroma extended about the margins. The surface epithelium thickened into two or three cell layers and sometimes into small blunt sprouts. Some blunt sprouts broke away and formed small clusters of cells in the liquefied medium or stroma cells. The epithelium in the tubules thickened like that of the surface epithelium but without buds. Portions of the explants failed to grow; the loss by fragmentation in the liquefied medium and in the manipulations of transfer markedly diminished the mass of cells. Cultures surviving ten to fourteen days or longer were often reduced to dimensions of 1 or 2 mm. in diameter. When, fortuitously, the cells grew on the surface of the medium with a minimum of liquefaction, thin sheets of polyblast cells equalling several square millimeters dimension, grew in twenty-four to forty-eight hours. The fibroblastic stroma cells grew out along the edge of only a few cultures as stellate cells with long fibrils. The epithelium after thickening into several layers, became relatively stationary and did not extend in solid masses of cells into the medium. In fact, the relation of the epithelium to the stroma portions was maintained in the explants in an orderly way just as in the tissues of the endometrium in

vivo, with the exception of a slight hyperplasia. In a few explants, the growth of epithelium resembled that of an infiltrating carcinoma. This, however, was exceptional. The regeneration of epithelium in tubules from the basal layers was observed clearly in certain explants where the lining epithelium had desquamated. The desquamated epithelium of such tubules occupied the lumen; a lining of regenerated epithelial cells had replaced those lost. Epithelial cells in mitosis were observed more frequently in the younger cultures than in the older. Small mats of cotton fibers introduced into the mediums with the explants did not overcome the difficulties of tissue fragmentation. The epithelial cells in such cultures extended along the cotton fibers but thickened only into layers of two or three cells. Careful surface implantation of the explants made no appreciable difference in the growth of cells. Explants grown under anaerobic conditions survived only a few days. The growth of tissues in these cultures was not different from those grown aerobically. Glycogen granules were not found in the epithelial cells of explants surviving seven to twelve days.

#### COMMENT

The behavior of the epithelium in explants of endometrium from uteri of women during the childbearing years, introduced into a medium of human plasma and endometrial tissue extract, in some respects resembles but, in others, differs from that reported for the epithelium of embryos or young animals. Fischer's<sup>8</sup> monograph described a growth of epithelium in sheets on the surface of culture mediums following a short latent period. Groups of epithelial cells in these surface growths arranged themselves in rings which resembled cross sections of glands. Fischer, in old cultures, noted giant cells, retrogressive changes, and variations in the size and shape of the cells. He ascribed these to differences in the consistency of the medium or to the position of the explant in the medium. When the growth of epithelium occurred in membranes, according to Fischer, it was rapid and extensive, but when tubules formed, the rate of growth was much slower and the actual increase in mass was small. In some of Maximow's<sup>7</sup> cultures of the mammary gland of the rabbit, growths of epithelium resembling carcinoma occurred. Herzog's<sup>9</sup> recent review summarized the studies on the behavior of epithelium in explants. In general, his conclusions were the same as Fischer's.

The growth of epithelium in the human endometrial explants of our cultures was not in sheets but was limited to a hyperplasia of the cells into several layers and small buds. The epithelium of explants surviving ten to fourteen days or longer covered the stroma portions of the explant in an "organoid" way, as Maximow proposed. Explants that survived a month had a little of the original fibrillar stroma tissues and were covered by a single layer of large cuboidal epithelial cells.

These experiments demonstrate that the medium of human plasma and tissue extract prepared from human endometrium sustains life and promotes growth of the tissues in human endometrial explants at least a month, although after this time these activities are small. The tissues surviving this length of explantation are mainly epithelium. Maximow thought that various stimuli may have contributed to the carcinoma-like growth of epithelium noted in his cultures of the rabbit mammary gland.

These, he stated, were (1) mechanical, the trauma of tissues; (2) chemical, the presence of some constituent of the tissue extract; and (3) the potentials of the epithelium in the host before explantation, such as its state of activity, and individual and racial peculiarities. The medium used in the cultures of endometrium probably contained constituents which occur regularly in endometrium living in the human body. It should produce no greater stimulus than that taking place with the usual cyclic changes of the uterus.

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## BILATERAL RENAL AGENESIS IN THE FETUS, ASSOCIATED WITH OLIGOHYDRAMNIOS

GAYLORD S. BATES, M.D., DETROIT, MICH.

(From the Department of Pathology, Harper Hospital)

COMPLETE absence of both kidneys is an anomaly of great rarity and is apparently always associated with oligohydramnios, in itself a phenomenon rarely encountered. The report of two cases is thus of great interest as a matter of record and, in addition, invites attention to the question of the function of the kidneys in fetal life and of the source of amniotic fluid.

CASE 1.—Mrs. J. H., aged thirty, white, para ii, entered Harper Hospital at 2 P.M., September 22, 1930, a private patient of Dr. A. W. Coxon, for an elective cesarean section. A section had been done three years previously for placenta previa, followed by a prolonged convalescence from postoperative pelvic infection.

The last menstrual period was December 25, 1929. Estimated date of confinement October 1, 1930. Quickening at four months. In August there was bloody show for three days, with some uterine contractions. At the time of admission, the patient was not in labor. Physical condition good. Urine negative. Fundus of uterus 4 fingers below the xyphoid. Fetal heart regular, rate 130.

A classical cesarean section was done under spinal anesthesia, using 150 mg. of novocaine. Amniotic fluid was entirely absent. Breech presentation found. The fetus was pink in color and seemed fully developed, but did not breathe except for occasional spasmodic gasps. In spite of various stimulants regular breathing could not be established and the heart action ceased one hour after delivery.

Postmortem examination demonstrated a well developed and well nourished fetus, length 45 cm., weight 1985 gm. There were no deformities discernible by palpation or inspection. The internal organs were well developed and in their normal relationships except for the urinary system. In the position normally occupied by the right kidney lay a brownish kidney shaped organ 40 by 30 by 7 mm., weighing 4 gm. On the left side was a similar organ 45 by 30 by 7 mm., weighing 5 gm. These

proved to be suprarenal glands. By following down the remains of the urachus a rudimentary bladder with a rugous lining was found, whose internal surface measured 9 by 6 mm. The urethral opening into the bladder was present but there were no ureteral openings. No ureters, or structures resembling them, could be demonstrated. The testicles were in the scrotum.

The microscopic findings were not remarkable. The placenta appeared normal in the gross and in the stained section.

CASE 2.—Mrs. R. B., aged twenty-four, white, para iv, entered Harper Hospital far advanced in the second stage of labor at 9 p.m., November 7, 1930, as a private patient of Dr. H. C. Maek.



Fig. 1.—Dissection of abdominal cavity in fetus of Case 2. The suprarenals are readily seen as the large, thin ovoid bodies of the upper abdomen. Below the right suprarenal is the right testis supplied by a branch of the suprarenal artery. Just below the bifurcation of the aorta on the sacral promontory lies a small irregular fibrous mass containing scattered hypoplastic glomerular bodies and fetal type tubules (Fig. 2). From its lower edge a fibrous cord extends to a pea sized bladder which may be identified as a grayish body lying in the pelvis.

She had had 2 living children, followed by a stillbirth at eight months in June, 1929, the cause of which was not determined. The last menstrual period was January 21, 1930. Estimated date of confinement November 2, 1930. Quickening at four months. This patient was seen at regular intervals throughout pregnancy by Dr. Maek, the last examination being one day before entry. Nothing abnormal was noted at any time. Fetal movements were felt up to the onset of labor, which occurred a few hours before admission to the hospital.

Upon admission the fetus was presenting S.L.A. at the vulva, so delivery was done without further examination. A 2500 gm. fetus of good color was delivered which, however, did not attempt to breathe, rapidly became cyanotic and was pronounced dead ten minutes after delivery. Because of the appearance it was presumed that death occurred at, or shortly after the time of delivery, and not in utero. No amniotic fluid was noted at the time of delivery and the patient stated emphatically that none had been lost before or during labor although it was present in appreciable amounts in her three previous deliveries. The placenta was 10 cm. in diameter, and contained numerous infarcts.

Postmortem examination demonstrated a well developed and well nourished fetus, 49 cm. in length, weighing 2500 gm. There was an imperforate anus and the testicles were not in the scrotum. There were no abnormalities of the internal organs except

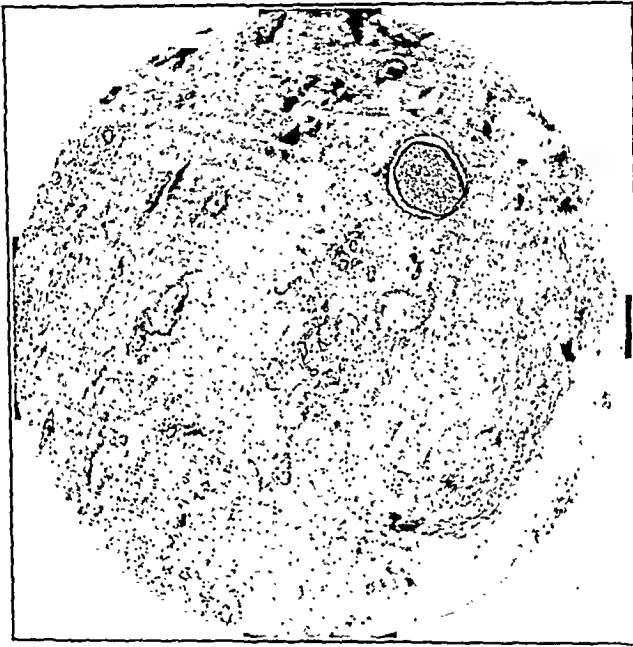


Fig. 2.—This represents a section taken from the fibrous mass on the sacral promontory. With considerable difficulty a field was found which contained a hypoplastic glomerular body. Scattered fetal type tubules can be seen.

those relating to the genitourinary system. In the position normally occupied by the kidneys were thin, brown kidney shaped organs weighing 4 and 5 gm. The bladder was found to be a very small organ with a small collapsed cavity from the base of which extended a duct through the prostate to a small, irregular, firm gland-like structure situated on the sacral promontory, which proved to be undeveloped kidney tissue. The testicles, with epididymis and vas deferens, were lying free just above the brim of the pelvis. The inferior vena cava existed as two trunks continuing upward from the iliac veins. The right hypogastric artery was absent and the left common iliac which gives rise to the left hypogastric artery was larger than the right. The rectum terminated at the base of the bladder but did not communicate with it (Fig. 1).

Microscopic examination revealed abnormal findings only in the lung, kidney remains and placenta. The lungs were completely atelectatic with deposits of hematoïdin throughout the alveoli. The kidney remains consisted of a fibrous mass interspersed with fetal type tubules and an occasional hypoplastic glomerular body.



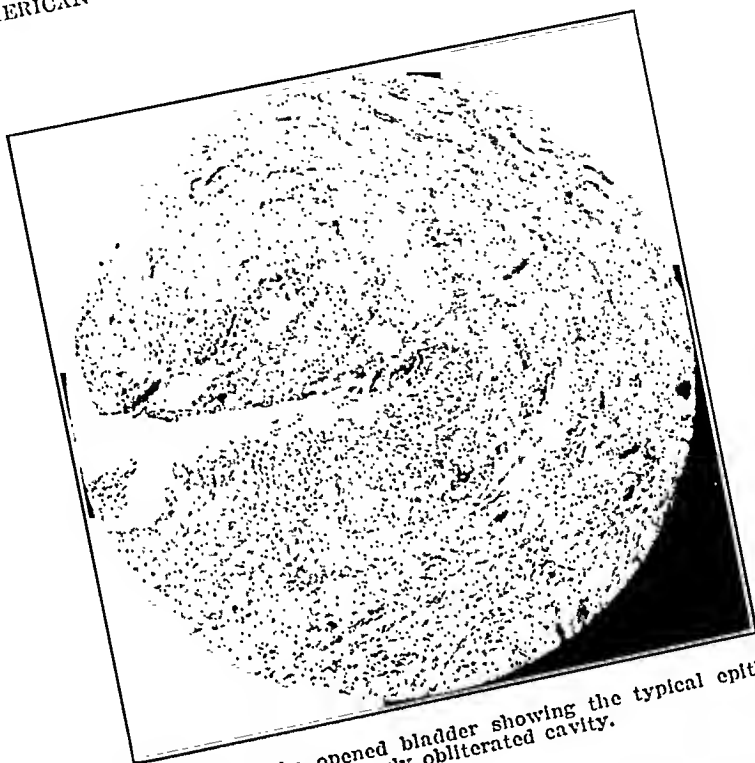


Fig. 3.—Cross section of the opened bladder showing the typical epithelial lining of the nearly obliterated cavity.

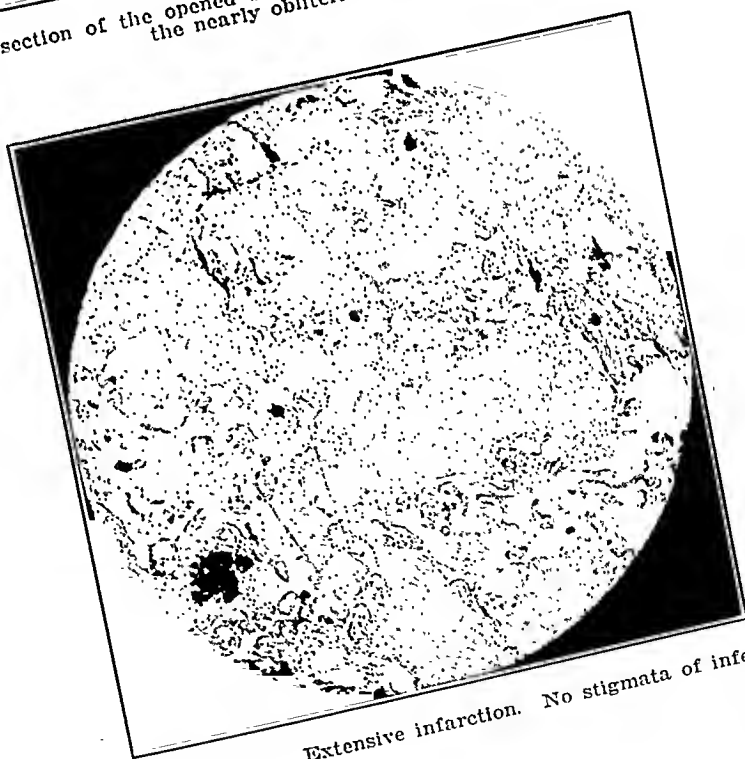


Fig. 4.—Placenta. Extensive infarction. No stigmata of infection.

The bladder and prostate were not remarkable. The placenta showed an unusual amount of infarction and calcification, but no evidence of infection (Figs. 2, 3, 4).

In five of the cases presented in Table I we may assume that the caudal portion of the nephrogenic cord failed to develop metanephrogenic tissue and coincidentally, no budding occurred at the lower end of the wolffian duct. In two cases ureteral budding did take place as evidenced by ureteral remains in the form of a fibrous cord in one and a small amount of eccentrically placed hypoplastic kidney tissue in the other. The defect in development then had its beginning at about the 5 mm. stage, or fourth week, at which time the mesonephros is most fully developed.

In 1921 Huerzler described a fetus with complete absence of both kidneys associated with oligohydramnios, and stated that search of the literature revealed only two similar cases, those of Hoenes and Hochsinger. However, Giles and Strassmann had each observed this condition and recorded a case previous to Hoenes and Hochsinger.

Table I presents all reported cases of bilateral renal agenesis including the two studied by the writer.

TABLE I. TOTAL REPORTED CASES OF COMPLETE AGENESIS OF BOTH KIDNEYS

AUTHOR	AGE SEX	VIABILITY AT BIRTH	LIQUOR AMNII	EXTRA URINARY ABNORMALITIES	ANOMALIES OF URINARY TRACT
Giles 1892	Term Male	Viable	No note made in case re- port	Imperforate anus, malformed feet; rectum and bladder, absence rt. hypo- gastric artery, un- descended testes	Absence both kid- neys and ureters
Strassman 1894	8 mo. Male	Viable	None	Bilateral club feet, undescended testes	Absence both kid- neys and ureters
Hoenes 1895	Term ?	Viable	None	Compressed cervical vertebrae, club feet, closure posterior fontanelle	Absence both kid- neys, rt. ureter present as a cord
Hochsinger 1899	Term ?	Viable	None	Bilateral club feet, dislocation of both hips	Absence both kid- neys and ureters
Huerzler 1921	Term Male	Viable	None	Undescended testes	Absence both kid- neys and ureters
Author's case 1930	Term Male	Viable	None	None	Absence both kid- neys and ureters
Author's case 1930	Term Male	Viable	None	Imperforate anus, ab- sence rt. hypogas- tric artery, unde- scended testes, dou- ble inferior vena cava	Absence both kid- neys. Small clump abnormal renal tissue on sacral promontory with duct to bladder

In addition to the above are several cases of hypoplasia of the renal system so complete as to leave no doubt of the nonproduction of urine. Academically they are to be distinguished from the cases of complete agenesis but from their association with oligohydramnios cannot be distinguished in considering the relation of fetal urine to the production of amniotic fluid. Table II outlines this anomalous condition and its associated features.

TABLE II. REPORTED CASES OF EXTENSIVE RENAL HYPOPLASIA WITH OLIGOHYDRAMNIOS

AUTHOR	AGE SEX	VIABILITY AT BIRTH	LIQUOR AMNII	EXTRA URINARY ABNORMALITIES	ANOMALIES OF URINARY TRACT
Jaggard 1894	Term Male	Viable	None	No rectum. Imperforate anus. Bilateral hip dislocation. Absence lt. sternocleidomastoid muscle	Absence left kidney and ureter. Small cystic rt. kidney, obstructed rt. ureter, and urethra
Hauch 1908	8 mo. Male	Viable	None	Undescended testes, double pes plano valgus	Bilateral kidney aplasia
Walz 1923	8 mo.	No note	None	Absence genitalia, cloaca present. Left club foot, polydactylia, umbilical artery continuous with aorta	Both kidneys a clump of pinhead sized vesicles. No urethra
Bardram 1930	8 mo. Male	Viable	None	Club feet	Absence rt. kidney and ureter. Lt. kidney enlarged, entirely cystic. Bladder pea sized, empty
Bardram 1930	8 mo. Female	Viable	None	Bicornate uterus	Kidneys low, small, hypoplastic. No lt. ureter. Bladder tiny, empty
Bardram 1930	8 mo. Male	Viable	None	Aplasia left tibia, micromelia left leg, one toe on left foot, spina bifida, imperforate anus, undescended testes	Bilateral kidney aplasia
Bardram 1930	8 mo. Male	Viable	None		

There are several observations of interest to be made on these two series as a whole, apart from the common urinary anomaly of the first group. Ten fetuses were males, one a female, in three this knowledge of the sex could not be obtained, and all were at or near term; all were viable at birth save one (no note) but lived less than one hour; in all but one there was a definite history of oligohydramnios, and in this case the

presence or absence of amniotic fluid was not indicated; associated deformities were malformed feet, malformed rectum and bladder, absence of rectum, imperforate anus, persistent cloaca, polydactylia, spina bifida, aplasia of the left tibia, bicornate uterus, compressed cervical vertebrae, closure of posterior fontanelle, dislocation of hips, undescended testes, and absence of the right hypogastric artery. In other cases of oligohydramnios, fracture and bending of long bones, and ichthyosis have also been observed. Some of these deformities, and many others such as harelip, are seen with normal and even excessive amounts of amniotic fluid, and Ahlfeld has even observed cases of ichthyosis with normal amounts of amniotic fluid. Certain of these deformities, as club foot, fracture and bending of long bones, compressed vertebrae, and possibly ichthyosis can be accounted for by mechanical influences following oligohydramnios. The others are developmental failures independent of the lack of amniotic fluid. From the fact that all fetuses were at or near term and viable at birth, it seems fair to assume that fetal kidneys play a negligible rôle in the physiology of the fetus, but by inference from the death of all fetuses shortly after birth, the kidneys must assume a major rôle immediately after being cut off from the maternal circulation, as do also the heart and lungs.

These 14 cases of renal agenesis and hypoplasia associated with oligohydramnios are of great importance when one considers the question of the source of amniotic fluid, for proponents of the fetal urine theory look for their greatest support in those instances of oligohydramnios associated with urinary anomalies. Considered alone these cases of complete renal agenesis, together with the cases of renal hypoplasia would seem to afford sound evidence in favor of this theory. There might also be added as evidence the fetus of Bertkau, full term, no amniotic fluid, and the urethra obstructed by a membrane which, when ruptured, allowed the escape of a half ounce of turbid urine; and Neumann's case of sirenomelus with renal agenesis and oligohydramnios.

Polyhydramnios not infrequently occurs in unioval twin pregnancy, affecting only one amniotic sac, and in these cases it is difficult to escape the conclusion that fetal urine has to do with overproduction of fluid. The twins as a rule differ markedly in size; the heart and lungs of the larger twin are greatly hypertrophied; the polyhydramnios affects the amniotic sac of the larger twin, that of the smaller twin containing a normal or a diminished quantity of the fluid. The umbilical vessels of unioval twins always anastomose freely in the single placenta and, if for some reason one twin obtains more than its fair share of the circulating blood, its heart and kidneys hypertrophy, with the result that the secretion of urine is greatly increased and polyhydramnios follows. Opposing this observation are the cases of Benthin who found practically the same sized kidneys in certain unioval twins despite great differences in the quantity of amniotic fluid. However, a careful review of the litera-

ture by Schiller and Toll in 1927 shows but 57 reported cases of oligohydramnios of which only 15 present malformations of the urinary tract, many of these 15 showing neither complete renal aplasia nor obstruction to urinary outflow, such as Schiller and Toll's case with left kidney and ureter absent, but right kidney compensatorily enlarged and with double ureter. Then again, Wagner has reported many cases of aplasia and atresia of the urinary system with normal and even excessive amounts of amniotic fluid.

Schiller and Toll studied carefully their case of oligohydramnios with an anomalous development of the urinary system, previously mentioned, and found a diffuse chronic inflammatory change with infiltration of leucocytes in the placenta, amnion, and chorion. The amniotic epithelium was nowhere degenerated and showed on its fetal surface only cuboidal and flattened forms which are described as normal for the middle of pregnancy. However, the vacuolated structure and drops of secretion which Forsell describes as characteristic for the normal amniotic surface, was nowhere observed, and the conclusion is drawn that histologically no ground can be found for attributing a secretory activity to the peripheral amniotic epithelium in this case. They believed that toxic products passing from the infected placenta directly into the amniotic sac must have altered the function of the secretory epithelium even if it did not destroy the epithelium, and on this basis explained the oligohydramnios. In the cases presented by the author no evidence whatever could be found of inflammatory changes in placenta or membranes.

That the oligohydramnios is not the cause of the renal agenesis is certainly true, especially in the light of Ahlfeld's statement that decrease or disappearance of the amniotic fluid takes place in the latter half of pregnancy, long after the embryologic defect has become manifest. That the oligohydramnios is the result of failure of adult functioning renal tissue to develop and not a coordinate phenomenon must remain a debatable question. The numerous cases of oligohydramnios with normal kidneys is clear evidence that they are not the decisive element in the production of the amniotic fluid. This fact is further borne out by those cases with a normal amount of amniotic fluid despite malformations of the kidneys or closure of the urinary passages. These cases of kidney malformations with normal amounts of amniotic fluid, on the one hand, and normal kidneys with oligohydramnios, on the other, speak against cause and effect, yet it is impossible to ignore the fact that 6 of the 7 cases of complete renal agenesis and all 7 of the cases of renal hypoplasia with absent renal function were associated with oligohydramnios, and in the seventh case of the former series the record is incomplete.

Further evidence from clinical observations to indicate a positive relationship between fetal urine and the production of amniotic fluid is to be found in a study by Bardram. He examined the postmortem records of all the cases of kidney anomalies found in children, either stillborn or dying shortly after birth, and who were autopsied at the Pathological-Anatomical Institute of Copenhagen from 1911 to 1929. This study was undertaken to see the relationship of kidney malformations in general to oligohydramnios.

He found: 7 cases of hypoplasia renum  
 2 cases of unilateral polycystic kidney  
 12 cases of bilateral polycystic kidney  
 4 cases of horseshoe kidney  
 12 cases of unilateral hydronephrosis  
 13 cases of bilateral hydronephrosis  
 2 cases of bilateral kidney aplasia  
 8 cases of unilateral kidney aplasia

By examining the hospital records of the births of these fetuses he found that oligohydramnios occurred in:

100 per cent of the cases of bilateral kidney aplasia  
 100 per cent of the cases of unilateral kidney aplasia with hypoplastic solitary kidney  
 67 per cent of the cases of bilateral polycystic kidney  
 43 per cent of the cases of hypoplasia renum  
 0 per cent of the cases of unilateral kidney aplasia with normal solitary kidney  
 0 per cent of the cases of unilateral polycystic kidney  
 0 per cent of the cases of unilateral or bilateral hydronephrosis

Bardram's study together with the 14 cases reviewed in this paper certainly make it reasonable to assume clinically, at least, that the fetal kidneys play some rôle in producing amniotic fluid though its exact nature is not yet known.

From another quarter comes more recent evidence, adduced from extensive physical and chemical studies of maternal blood serum, fetal urine and amniotic fluid, to give added weight to the inferences drawn from the clinical observations already discussed. Makepeace and co-workers were able to show that ". . . at term the amniotic fluid is distinctly hypotonic to maternal serum, but in the earlier months of pregnancy this hypotonicity is less, and in the earliest months the amniotic fluid may be isotonic with maternal serum. Thus, early in pregnancy the amniotic fluid approaches the composition of other protein free fluids which are in osmotic equilibrium with the blood plasma. This suggests that the amniotic fluid originates as a dialysate in equilibrium with the maternal and fetal body fluids. The fetal urine is definitely hypotonic and is present in the bladder as early as the fourth month in pregnancy. This indicates as pregnancy advances the amniotic fluid becomes more and more diluted by the hypotonic fetal urine."

The relationship of fetal urine to the production of amniotic fluid is further implied by a consideration of the embryologic development of the kidney in the light of observations made by three men. The metanephros or adult kidney is developed to the point of function somewhere between the third and fourth month of embryonic life. Makepeace was able to obtain urine from a fetus three to four months of age; Zangmeister concluded that as early as the fifth month of pregnancy the amniotic fluid must be diluted with an appreciable amount of fetal urine; and Ahlfeld states that the disappearance of the amniotic fluid takes place in the lat-

ter half of pregnancy. We may fairly assume that in the 14 cases presented amniotic fluid was present early in pregnancy, before the fourth month. At this time the metanephros failed in development and no urine was formed, following which the production of amniotic fluid ceased. If amniotic fluid were entirely a transudate from maternal blood, or a secretion of the amniotic epithelium, one would expect some fluid to have been present at term. Therefore another factor must be necessary, namely the presence of secreted fetal urine.

Schiller and Toll advance an enticing theory that the fetal kidneys produce only small amounts of a highly concentrated urine which, acting as an irritant, stimulates the amniotic epithelium to secrete fluid of low concentration. This theory may well explain the cases of complete renal agenesis associated with oligohydramnios, and their own case in which placental infection with its related inhibition of secretory function of the amniotic epithelium is well established, but it is difficult to apply to those cases of oligohydramnios in which no urinary anomaly occurred. However, even in those cases there may have been a pathologic condition in mother, fetus, or placenta either unobserved or unreported which altered function of either the amniotic epithelium or the fetal kidneys. Also, it is not incompatible with the view of Makepeace that amniotic fluid is originally a dialysate in equilibrium with maternal and fetal body fluids becoming more and more diluted by the definitely hypotonic fetal urine as pregnancy advances.

In conclusion it may be stated that oligohydramnios is rare; complete renal agenesis is extremely rare, but is apparently always associated with an absence of amniotic fluid; fetal kidneys play a negligible rôle in the physiology of the fetus except as they may relate to the production of amniotic fluid; and that these 7 cases of complete renal agenesis, 6 of which are associated definitely with oligohydramnios, together with 7 cases of extensive renal hypoplasia and oligohydramnios, afford presumptive evidence in favor of the view that there is a direct relationship between the production of fetal urine and the production of amniotic fluid.

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## REPORT OF A CASE OF OVARIAN EMBRYOMA\*

P. J. SARMA, M.D., M.Sc., F.A.C.S., CHICAGO, ILL.

*(From the Department of Surgery, University of Illinois College of Medicine and Ravenswood Hospital)*

REVIEWING the literature and our own cases I find that ovarian embryomas are not uncommon.

The terminology used for the classification of this form of tumor is very confusing. It has been called embryoma, teratoma, teratomatous, teratoblastoma, teratoid, dermoid, cystic and solid teratoma, mixed cell tumor, benign and malignant teratoma by various writers.

After an intensive study of this problem Willms<sup>1</sup> concluded that the dermoid cyst and teratomas of the ovary are genetically similar. They both contain all three embryonic layers. It was he who suggested the simple and anatomically correct term cystic and solid embryoma.

Out of 775 cases of ovarian tumors operated at the Ravenswood Hospital, fifteen cases of ovarian cystic embryomas were found. These were all unilateral tumors. The largest tumor in this series weighed two pounds. The youngest patient was twenty-three years old, the oldest sixty-four. One case of ovarian cystic embryoma with twisted pedicle was operated as a surgical emergency. There were no malignancies in this group.

Kroemer<sup>2</sup> found in his collected cases that thirty-four operations were performed with a primary mortality of 16 per cent. Out of 27 patients that recovered from operation, 16 or 59 per cent, died within the first or second year. Of 7 patients in this group that were considered cured, only 5 could be followed for more than five years, giving a curability of 25 per cent. Doderlein<sup>3</sup> gathered 51 cases in the literature. Twelve of this group were found well from six months to seven years after operation. He also found that only 4 cases were reported well after six to twenty-four years after surgical removal. Harris<sup>4</sup> collected 21 cases in the literature under the age of fourteen. The youngest girl of this group was under four. His own patient, five years and ten months of age, was found well ten years and eight months after operation. Eden and Lockyer<sup>5</sup> have gathered 16 cases of solid embryoma. The oldest patient in their group was thirty years old. Black<sup>6</sup> operated on two patients with solid embryoma of the ovary, one patient remaining well after three years and the other showing no sign of recurrence after fourteen months' observation. DeMora<sup>7</sup> has reported a patient of nine years of age having a large right ovarian solid embryoma. This case was operated by Gorst. There has been no recurrence in eight months.

Willms<sup>1</sup> considered the solid embryomas as originally benign, only secondarily showing malignant changes. Pfannenstiel,<sup>8</sup> Ewing<sup>9</sup> and Boyd<sup>10</sup>

\*Presented before the Chicago Gynecological Society, March 13, 1932.



feel that these tumors are malignant from the very beginning. Secondary involvement occurs from the perforation of the capsule and implantation in the pelvis, peritoneum, diaphragm and omentum. Histologically, solid embryomata present lawless growth of varieties of tissues derived from the ectoderm, endoderm and mesoderm. Though it is common to find mostly organs and structures of the cephalic portion, yet intestines, solid abdominal viscera, muscle, bone, cartilage, nerve, etc., are found. Some observers found that in this type of tumor the mesoblast gains ascendancy.

Studying the reported cases in the literature for some characteristic symptoms to aid in the diagnosis of this condition, one finds himself at a loss. The age of the patient and rapidity of the growth should always

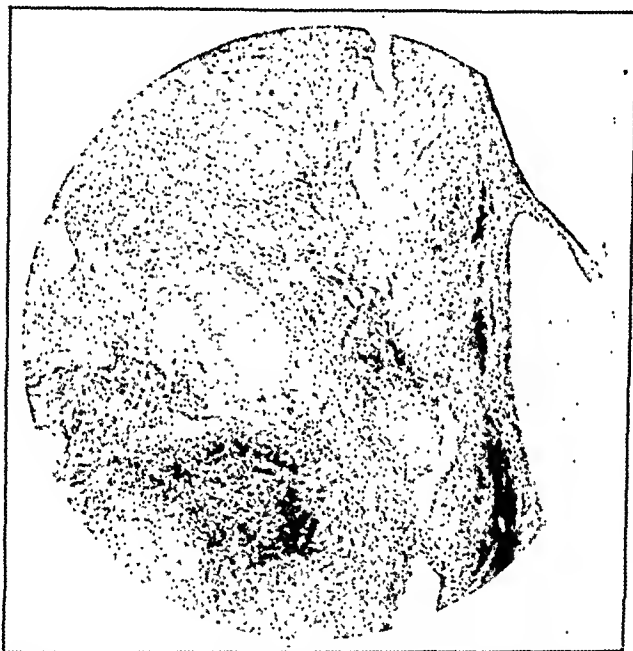


Fig. 1.—First tumor under low power  $\times 52$ , solid embryoma.

bring solid embryoma to mind for differential diagnosis. Premature puberty with precocious somatic development has been reported by few observers.

Symptoms of pressure from the size of the tumor has been found in a majority of the cases. Aseites was usually present in young patients. Gardner<sup>11</sup> has pointed out that malignant tumors arising in a solid embryoma are usually mixed, carcinoma, rhabdomyomas or sarcomas, etc., depending on which elements partake in the malignant changes.

*Case Report.*—L. V., a girl, five years and four months old, was admitted under my care at the Ravenswood Hospital on January 7, 1930. Patient's chief complaint was of a rapid growing abdominal enlargement. Examination revealed that she was a normally developed girl whose past history was unessential except for a mild attack of measles when three years old. She had suffered from periodic attacks of vomiting since

childhood. These were generally brought on by nervous excitement. A presystolic murmur in the mitral region was present but the heart was otherwise normal.

About six months before consulting me, the child's mother noticed that the patient's abdomen was growing large with great rapidity. Examination revealed a very decided enlargement of the whole abdomen and on palpating, a firm smooth mass was found which extended from the ensiform cartilage to the symphysis pubis, towards the left side. The mass was somewhat fluctuant but not movable from side to side. The abdomen over the surface of the mass was dull to percussion. Pressure over the tumor elicited no tenderness but produced slight dyspnea. Absence of tympany over the abdomen indicated that the mass was external to the intestines. Putting the patient in the knee-chest position and palpating in the back, the possibility of a retro-(extra-) peritoneal tumor was ruled out. A series of roentgenograms made elsewhere was of no diagnostic help. There were no genitourinary symptoms present. No rectal or vaginal examination was made. Wassermann negative; hemoglobin 53 per cent; erythrocytes 4,160,000; leucocytes 16,000; small lymphocytes 21 per cent, polymorphonuclear neutrophils 79 per cent.



Fig. 2.—Same, under high power  $\times 320$ .

A preoperative diagnosis of an ovarian tumor was made, though the location suggested a large cyst of the spleen which could not positively be ruled out without an exploration.

On January 8, 1930, under ethylene and oxygen anesthesia, a left paramedian incision with lateral retraction of the rectus muscle gave an excellent exposure of the tumor. The incision was four inches long and extended one and one-half inches above and two and one-half inches below the umbilicus. A large glistening tumor could be seen through the thin, almost transparent omentum. The multilocular tumor was not adherent to any neighboring structures. It was easily identified as a left ovarian growth and was removed intact by ligating the long vascular pedicle. The opposite ovary and neighboring organs were found normal. The abdomen was closed in the usual way, the operation lasting only forty minutes.

Aside from a slight rise in pulse and temperature for the first forty-eight hours, the postoperative course was perfectly smooth. The stitches were removed on the eighth postoperative day and the wound healed by primary intention. The patient left the hospital on January 19, 1930, twelve days after operation, in perfect condition. Our pathologist, Dr. L. C. Murphy, reported the pathologic findings of the tumor as follows:

"The specimen is a multilocular cystic tumor weighing 1370 grams (4.7 pounds) and measuring about 19 by 17 by 9 cm. The entire surface is smooth, glistening and in-

taet. Many of the cysts form projecting knobs on the surface. Some of the externally situated cysts are partially filled with thin, amber colored fluid but the greater portion of the mass is composed of compartments filled with edematous yellowish-white honey-combed tissue with lobulated appearance. In some compartments this tissue is firm and elastic while in others it is of a softer, semi-gelatinous consistency. Small calcified areas are noted in the solid, white tissue in some of the compartments. The microscopic sections show the structure of a teratoma in which the following tissues are represented: Cartilage, bone, muscle, fat, glands, ovarian stroma, squamous epithelium."

The patient was kept under observation and was regularly examined every two weeks. The progress was found very satisfactory. Repeated abdominal palpation revealed no enlargement. On October 21, 1930, the patient was examined and showed very satisfactory results.



Fig. 3.—Second tumor removed Dec. 5, 1930, 5 pounds, anterior view.

On November 20, following the last inoculation of diphtheria antitoxin at the public school, the patient developed vomiting, chills, and high fever. Though the fever subsided within three days, the mother noticed a fullness of the child's abdomen. Thinking that it might be gaseous distention she did not consult me until the twenty-ninth of November, exactly nine days after the inoculation of the antitoxin. The mother stated that "the abdomen grew larger every day." I found the abdominal measurement showed a growth of five and one-half inches in the level of the umbilicus since the last examination. The mass was smooth and firm in palpation. It was much harder than the first tumor. The tumor filled the whole abdomen and the exact relation of it could not be clearly outlined. General examination indicated that the patient was in excellent condition for operation. The urine examination was negative except for a very faint trace of albumin. Blood picture showed hemoglobin 75 per cent, erythrocytes 4,220,000, leucocytes 11,750.

The patient entered the Ravenswood Hospital on Dec. 4, 1930, and was operated on under ethylene and ether on Dec. 5, 1930. The tumor was reached through the old scar. Some free bloody fluid was found on opening the abdomen. A large solid tumor filled the abdominal cavity. Its anterior part was attached to the greater omentum. This was easily ligated and separated. Three inches of ileum were attached to the posterior central part of the tumor. It was not possible to separate



Fig. 4.—Second tumor under low power. Adenocarcinoma  $\times 52$ .

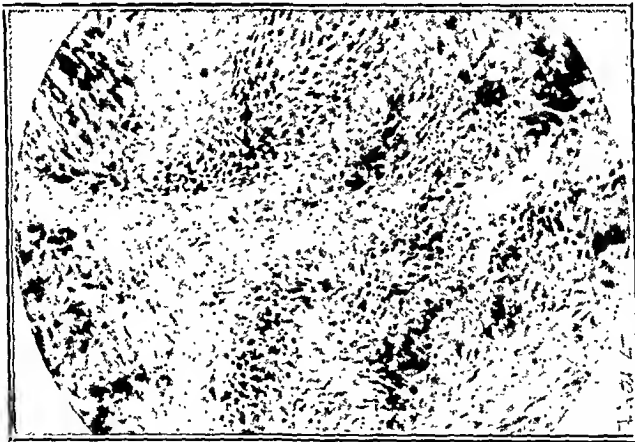


Fig 5.—Same, high power  $\times 320$ .

the intestine without cutting the tumor tissue, so six inches of the ileum were resected. A lateral anastomosis established its continuity. The abdomen was closed after a careful survey of the neighboring structures. No pathology could be found in the right ovary. No metastases were visible or palpable. The operation lasted one hour and twenty minutes.

The patient's rectal temperature rose to  $103^{\circ}$  F. for six hours after the operation. There was a normal bowel movement on the third postoperative day. Convalescence

was uneventful. Sutures were removed on the eighth postoperative day. There was primary healing of the wound. The patient left the hospital in excellent condition on the tenth postoperative day. The pathologic report by Dr. Murphy was as follows:

"The specimen is a round, solid tumor mass weighing five pounds. The external surface is smooth, of a dark mottled color with nodular irregular, bulging areas ranging in size from a walnut to an orange. The interior is composed of soft, edematous, yellowish-white tissue which becomes mottled with hemorrhage near the surface. Microscopic sections show practically the same structure as the tumor removed in January, 1930, viz., teratoma, except that in this second tumor there is a greater proportion of glandular epithelium indicating a more malignant structure (adenocarcinoma)."

The patient's convalescence was satisfactory for about three months after the last operation. On March 30, 1931, fluid accumulation in the abdomen was noticed. Enlargement of the right cervical glands was present. The patient became quite anemic and markedly debilitated. The intraabdominal fluid grew rapidly and it was necessary to remove one gallon of it, on May 14, 1931, to relieve respiratory embarrassment. Large abdominal mass, and the enlargement of the liver could be palpated at this time. The patient grew weaker and died on May 21, 1931.

Autopsy was refused.

*Summary and Conclusion.*—1. Ovarian embryomas are subdivided into cystic and solid types on anatomic grounds by Willms. This is the least confusing terminology.

2. The cystic embryoma is a common form of ovarian neoplasm. In a series of 775 ovarian tumors at the Ravenswood Hospital, 15 were cystic embryomas. This is a much lower percentage than found in other clinics.

3. The solid embryoma is a very rare ovarian tumor. It is malignant from the very beginning. A case of this type is reported in a girl of five years and four months of age. The tumor occurred in the left ovary and weighed 4.7 pounds. This was removed intact without difficulty. It recurred after eleven months. The tumor grew rapidly and filled the abdomen within nine days. Operation revealed a five-pound tumor originating in the greater omentum. The close adhesion to the ileum required a resection of six inches of the bowel. A lateral anastomosis established the continuity of the intestine. Postoperative recovery was satisfactory. The patient died within six months after the last operation from recurrence and metastasis.

4. Every solid embryoma should be considered potentially malignant. The study of the literature impresses the necessity of prophylactic removal of all ovarian cysts in toto.

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## DISCUSSION

DR. LYMAN C. MURPHY.—I have seen two instances in which microscopic sections were made and a report given that no evidence of malignancy was found. In one case the pathologist even suggested a favorable prognosis and did not think x-ray was necessary. Both patients were dead within one year.

DR. IRVING F. STEIN.—The point brought out in reference to the malignancy of embryomas is important. The essayist said that they had had no experience with x-ray in the diagnosis of these tumors. I feel that they have missed something vital in the diagnosis. The large tumors, whether they be teratomas or cysts, indicate surgery from the size alone. The small growth from 2 to 4 cm. in diameter are very important from the standpoint of preoperative diagnosis and from the standpoint of whether or not they are to be attacked surgically. Our experience with the use of pneumoperitoneum in diagnosis is that we can detect many small ovarian tumors quite early and can differentiate various types of ovarian swellings by x-ray. Simple cysts, par-ovarian cysts and dermoids are readily distinguished, the latter by the presence of teeth, bone or small areas of calcification. We have shown that ovarian pathology can be visualized on the roentgenogram after pneumoperitoneum and thus determine whether operation shall or shall not be done.

DR. N. S. HEANEY.—Solid embryomas are so rare that single case reports are of the utmost importance. The condition of the remaining ovary at the time of the second operation in Dr. Sarma's case should be very definitely stated. Ovarian tumors are very frequently bilateral and when a patient has been operated upon for a tumor of one ovary and subsequently has to be operated upon for a second tumor the probabilities always are that the second ovary is also the seat of a tumor.

One point in the treatment of dermoids that I consider of some importance is that when one ovary is operated upon for a dermoid cyst the opposite ovary, though normal in appearance, should be carefully slit and inspected for the presence of a possible dermoid. If this is done one may occasionally find a dermoid no larger than a pea or bean which may be easily removed and prevent an operation at some future time when it has grown big enough to produce symptoms.

DR. DETARNOWSKY then stated that the right ovary was entirely normal, there was no pathology in the pelvis. He continued: The thing that puzzled us was to find out how there had been an implantation. At the first operation the original tumor was free of all adhesions. It was lifted outside without rupturing any of the cysts and was clamped without any difficulty at all and we could not see any signs of implantation anywhere. The child was normal all these months so that we felt that we had removed everything, and then she had this relapse. However, the opposite ovary had nothing to do with the second growth.

DR. ARTHUR H. CURTIS.—Do you not believe, in view of the serious prognosis, that it would usually be wise to give deep x-ray therapy to take care of the other ovary?

DR. DETARNOWSKY.—That is a good suggestion.

DR. FREDERICK FALLS.—I would like to recount a few interesting tumors of this type that I have encountered. The first was a large demoid cyst in the pelvis of a woman on the medical service of the University of Iowa, who had entered with a diagnosis of chronic rheumatism. The medical men could not find any focus of infection, except a mass in the lower abdomen which they took to be a pelvic abscess. This mass was opened and drained in July. Two months later the woman was still draining from the ovarian cyst and when I took over the service they told me there was a peculiar drainage from the vagina. We found on examining the vagina carefully that the interior of the cyst was full of maggots. During the hot summer flies had gotten in the

vagina and laid their eggs in this cyst. Since it was necessary to remove this dermoid, I took cultures from the cyst and found streptococci, staphylococci and colon bacilli. The woman was not a good surgical risk and yet because of the persistent discharge something had to be done to relieve her. We irrigated the cyst from the vagina thoroughly with weak iodine solution over a period of two weeks and reduced the number of bacteria. We then removed the cyst wall abdominally. After a rather stormy convalescence she recovered.

About three months ago a nurse, nineteen years old, was found to have a tumor about the size of a fist in the region of the ovary. I felt it should be investigated with the possibility that it might be a teratoma. She did not respond to the suggestion at once. Three weeks later the tumor was about twice the original size. I insisted that it should be removed at once and this was done. We found a teratoma. Feeling that, when we are dealing with a malignant tumor of the ovary, it is the general rule that the other ovary and uterus be removed, I removed the ovary and uterus from this girl.

About two years ago at the Research Hospital a girl about sixteen years of age was sent in with this history. She noticed a swelling of the abdomen. She told her mother about this and her mother took her to the family doctor who considered the possibility of a pregnancy. An x-ray picture was taken by a local dentist who said that the girl was pregnant. The father of this girl, on learning this, sent her to a reform school. The doctor in charge of this school looked her over and watched her for a month or two. The abdomen was growing about the rate a pregnancy would, but the heart tones could not be heard. The patient was then sent to the Research Hospital where we made a diagnosis of teratoma and found this at operation.

At the County Hospital about four years ago Dr. Schmitz did a hysterectomy with a right salpingo-oophorectomy. He did not remove the left ovary. Six months later the woman came in with a tumor in the region of the left ovary. I made a diagnosis of simple cyst, opened the abdomen and found a teratoma. Within six months after leaving in what appeared to be a normal ovary there had developed a teratoma.

Three years ago I took out a large cyst in an eighteen-year-old girl. This was a very rapidly growing cyst and proved to be a teratoma. All of these cases were malignant.

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## KRAUROSIS VULVAE, WITH A REPORT OF THIRTEEN CASES

M. A. GOLDBERGER, M.D., F.A.C.S., NEW YORK, N. Y.

*(From the Gynecological Service and Division of Laboratories of the Mount Sinai Hospital)*

**K**RAUROSIS is an atrophy of the vulva due to changes in the epithelial and subepithelial elements of the skin. It usually occurs in women past the menopause, but may occur in young women. Its etiology is not well understood. Lack of ovarian hormone is considered a factor because it usually occurs in the senium and there have been several reports claiming good results following the administration of female sex hormone. In the cases here presented, female sex hormone gave temporary relief in a very few instances and in no case changed the clinical or local condition. From this it may be inferred that the female sex hormone is not the important factor. Furthermore, while this disease is not rare, its incidence is very low even among the women who are past the climacteric. It is possible that an endocrine factor is the



Fig. 1.—Marked acanthosis and heaping up of the keratin layer. Elaiden granules stain deeply and connective tissue shows chronic inflammation.



Fig. 2.—Labia majora are flattened out and the labia minora have completely disappeared. The clitoris and prepuce are shrunk and the vulval orifice contracted so that it barely admits finger tip. Skin has the appearance of thin parchment and is pearly white.



cause, but the proper one has as yet not been determined. Veit believes that kraurosis is of inflammatory origin of long standing.

In the last decade, cancer prevention and early recognition have received widespread interest. Carcinoma of the vulva comprises 4 per cent of all carcinoma of the genital tract. Berkeley and Bonney state that the relationship born by leucoplakic vulvitis to carcinoma is closer than that of any other pathologic lesion with the exception of roentgen ray dermatitis.

The clinical and histologic picture of kraurosis vulvae is a typical one. Early in the disease (Taussig's first stage) the vulva appears swollen and reddened (kraurosis rouge of Jayle). Histologically, there is a pronounced acanthosis, an increased keratosis and an infiltration with

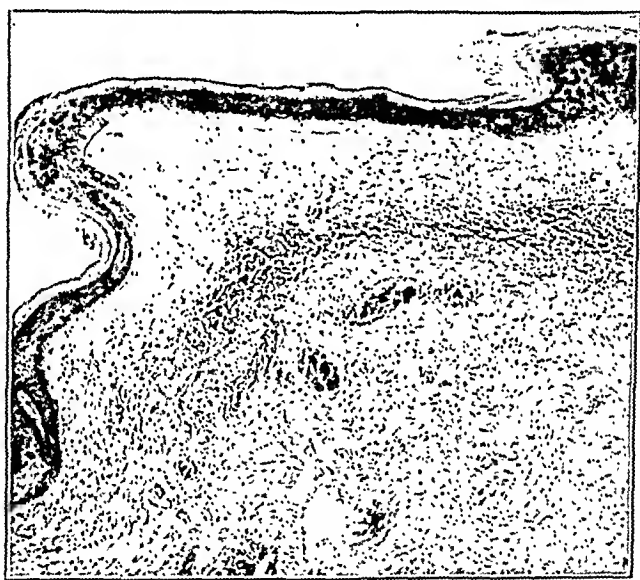


Fig. 3.—Low epithelial layer. Papillary processes are absent, eleiden granules sparse, connective tissue densely collagenous, and there are islands of round celled infiltration.

round cells and leucocytes. The second stage usually begins about one year after the initial appearance of the disease. The skin becomes white and firm and there may be excoriations from scratching. Microscopically (Fig. 1), there is still a marked acanthosis and heaping up of the keratin layer. The eleiden granules stain deeply, the connective tissue shows chronic inflammation with scattered areas of collagen and numerous plasma cells. This is called the progressive stage by Szasz and Veit. In the third stage (Fig. 2), the labia majora flatten out, the labia minora completely disappear, the clitoris and prepuce are shrunken and the vulval orifice contracts so that it barely admits the finger tip. The skin assumes the appearance of thin parchment, is pearly white, dry and cracks easily. This condition may at times involve only one area of a labium or be unilateral. The microscopic picture (Figs. 3 and 4), shows

a low epithelial layer. The papillary processes are absent, eleiden granules are sparse, the connective tissue is densely collagenous and there are islands of round cells. The elastic tissue (Fig. 5), is decreased in

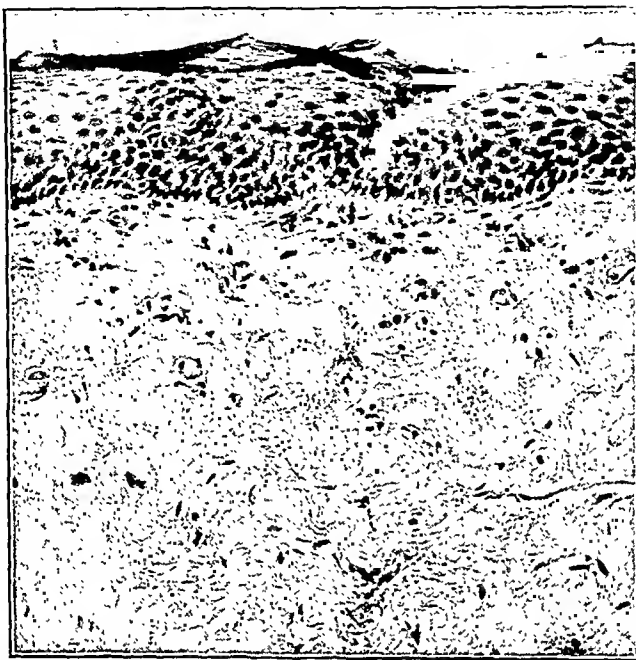


Fig. 4.—Higher power of Fig. 3 showing densely collagenous connective tissue.

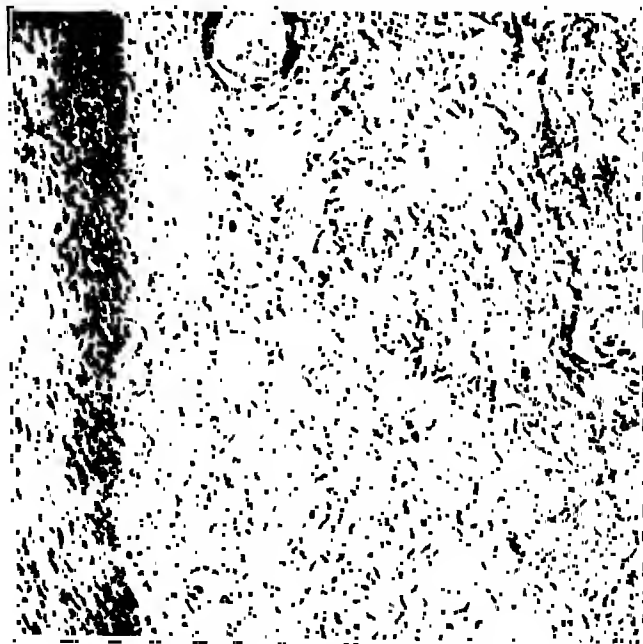


Fig. 5.—Elastic tissue stain showing elastic tissue broken up and arranged as bundles of twigs.

amount and appears broken up and arranged as bundles of twigs. This stage of kraurosis corresponds to what Szasz calls kraurosis sensu strictiori.

The most common symptoms that finally influence a patient to seek relief are pruritus and dyspareunia. Dysuria and frequency may also occur. These symptoms should be differentiated from other causes such as parasitic diseases of the vulva, diabetes, dermatologic lesions, and psychoneurosis.

The tabulated results of treatment of the thirteen cases of kraurosis vulvae studied may be divided into two groups (Table I). In Group I, there are five cases gathered from the out-patient and radiotherapy departments. They are all parous women past the fourth decade of life. Only one of these was still menstruating. In each case the symptoms and vulval lesions were characteristic of kraurosis. In three cases, low voltage x-ray was used without relief. In one, the Kromayer lamp was used, but the full course of treatments was not completed as the patient failed to return. Three of these patients received ovarian hormone, in the form of amniotin pessaries. In one, four suppositories a day were given over a period of two and one-half months without improvement.

In Group II (Table II), there are eight cases of kraurosis vulvae, in all of whom vulvectomy was finally done. Their ages ranged from twenty-nine to sixty-five. The twenty-nine-year-old woman had never menstruated and showed no sex hormone cycle in her blood. The thirty-eight-year-old patient had a hysterectomy performed four years before. Of these cases only one was sterile, the patient with the primary amenorrhea. They all complained of pruritus and in three dyspareunia was the chief complaint. Female sex hormone or x-ray, or both were used in all cases but one. In every instance, the results were poor. At best, these patients had temporary relief, but in no case was there any effect on the local condition. In one patient, no previous treatment had been given as it was deemed inadvisable to temporize because of the marked fissuring of the kraurotic skin. It is this case that shows a very early carcinoma with kraurosis in the hyperplastic phase (Fig. 6). Six blocks cut one-eighth inch in thickness, adjacent to that showing malignancy, failed to demonstrate the carcinoma. This emphasizes the importance of cutting many blocks from a kraurotic vulva specimen submitted for examination. The eighth case had a superimposed eczema of the vulva which masked the kraurotic appearance of the skin. The kraurosis became evident after local treatment for the eczema. Here also the microscopic finding of an early carcinoma on a kraurotic basis was unexpected. The results in 6 of the patients in Group II were most striking following vulvectomy. Five are cured for from three to five years. The sixth and eighth case have recently been operated. The seventh case, in whom there is a recurrence, was a private patient, not on the service of the hospital.

TABLE I. NONOPERATED CASES

PATIENT	AGE	MENSTRUAL HISTORY	PARITY	SYMPTOMS	DURATION	TREATMENT	RESULT	CLINICAL PICTURE
J. B. 318 159	69	Menopause 16 years	8	Pruritus Diabetes	7 years	12 amniotin pessaries, Kromayer lamp 4 doses	No relief, treatment incomplete	Both labia minora white, slight scaling, skin atrophic
S. M. 14 448	73	Menopause 25 years	6	Pruritus	5 years	Low voltage x-ray	No relief	Leucoplakia, fissures
R. G. 319 246	43	Operated for ovarian tumor, 1910. Menstrues regular 14x28x7	3	Pruritus	3 years	Low voltage x-ray	4/29/30. Is relieved before and during menses	Atrophic labia minora with leucoplakia and fissures
E. G. 17 087	58	Menopause 6 years	8	Dyspareunia Pruritus	6 years	Daily $\frac{1}{2}$ c.c. of estrogen, P.D. for 7 days	No improvement	Atrophic labia minora, loss of clitoral folds, grey white appearance
I. W. 24 901	54	Menopause 14 years	5	Pruritus	3 years	4 amniotin pessaries per day for 2½ months, x-ray	No relief No relief	Atrophic labia minora, whitish in color

TABLE II. OPERATED CASES

PATIENT	AGE	MENSTRUAL HISTORY	PAIN- ITY	SYMPTOMS	DURA- TION	TREATMENTS	RESULT	OPERATION	PATHOLOGY	RESULTS
D. M. 331 930	29	Never men- struated	0	Dyspareunia Pruritus	2 yr.	Injection F. S. H. for 3 months, 3 R. U. per dose	Vulva unaffected. Temporary im- provement	Vulvectomy 1926	Atrophic stage	Cured. Last seen 11/1/31
E. K. 277 615	65	Menopause 15 years	7	Pruritus	3 yr.	8 injections of amniotin, 50 R. U. per dose. 2 courses of low voltage x-ray	No effect  No effect	Vulvectomy 3/18/27	Atrophic stage	Well
C. R. 288 613	48	Menopause 3 years	3	Pruritus	1 yr.	Injection F. S. H. for 4 months, 3 R. U. per dose	Temporary im- provement. No effect on vulva	Vulvectomy 3/15/28	Atrophic	Slight itching follow- ing vulvectomy. Re- lieved by injections of theelin, 250 R. U. for 1 month. Last seen 10/28/31, well
I. A. 302 578	47	Menopause 5 years	2	Dyspareunia Pruritus	3 yr.	8 theelin injections of 50 R. U. per dose. X-ray pituitary, x-ray vulva	No relief  No relief No relief	Vulvectomy 5/27/29	Hyperplas- tic stage	Last seen 9/17/30. Slight itching to right and posterior to vulva
I. H. 332 358	54	Menopause 5 years	9	Dyspareunia Pruritus	6 yr.	8 theelin injections of 50 R. U. per dose. X-ray pituitary, x-ray vulva	No relief  No relief No relief	Vulvectomy 11/10/31	Atrophic phase	
A. B. 289 342	38	Menopause 4 years, post-hys- terectomy	5	Pruritus	10 yr.	Low voltage x-ray	No relief	Vulvectomy	Atrophic	Pruritus. Not seen by us
C. G. 288 369	65	Menopause 25 years	1	Pruritus	2 yr.	None		Vulvectomy 2/7/28	Early ca. in kraurosis. Hypor- plastic phase	11/1/31, skin healthy. Vagina admits 2 fin- gers. No glands
D. G. 32466	57	Menopause 9 years	4	Pruritus	2 yr.	Low voltage x-ray and local treatment	No relief	Vulvectomy	Early ca. in kraurosis	

Taussig, in his analysis of 76 cases of carcinoma of the vulva, found that 39 were on a kraurotic basis, 60 per cent being in the leucoplakic stage and 40 per cent in the atrophic stage. In other words, about 50 per cent in his series showed kraurosis in either stage.

The microscopic slides and clinical description of 13 cases of carcinoma of the vulva from Mount Sinai Hospital have been studied. In 7 there

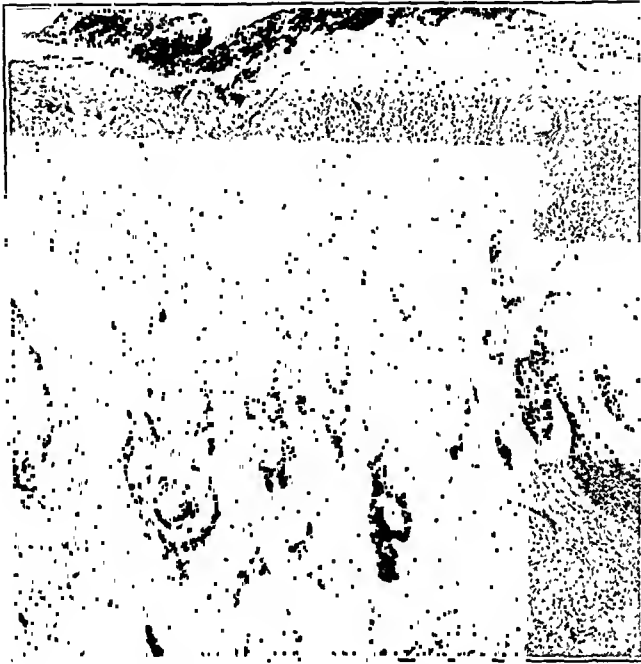


Fig. 6.—Early carcinoma, pearl formation and infiltration of connective tissue in a hyperplastic kraurotic lesion.

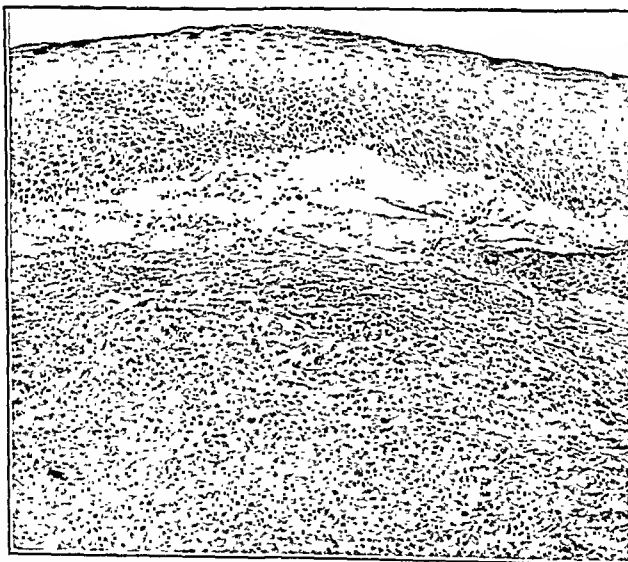


Fig. 7.—Advanced carcinoma in a kraurosis in the atrophic phase. Same lesion contains areas of kraurosis in hyperplastic phase.

was a coexisting kraurotic process (Fig. 7). They could not be grouped in the hyperplastic or atrophic stage because most of them showed both stages in the same specimen. The percentage of kraurosis in the carcinomas of the vulva studied corresponds to Tanssig's figure of 50 per cent. This high percentage of carcinoma associated with kraurosis and the poor results with medical and physical therapy leads to the conclusion that the method of treatment should be vulvectomy. Brettauer, Frank, Taussig, and many others have stressed the importance of vulvectomy for prompt relief and cure of kraurosis vulvae. It is here further emphasized that to cure kraurosis vulvae and forestall carcinoma, vulvectomy should be done.

#### SUMMARY AND CONCLUSIONS

1. Thirteen cases of kraurosis vulvae are analyzed, of which 8 were treated by vulvectomy.
2. Thirteen cases of carcinoma were studied in order to determine a relationship to kraurosis.
3. Both from the literature and this analysis, carcinoma was found to develop in kraurosis in 50 per cent of the cases.
4. Unsuspected carcinoma was present in 2 of the 8 cases treated by vulvectomy.
5. X-ray and hormonal therapy is ineffective.
6. Vulvectomy is the treatment for cure of kraurosis and prevention of carcinoma.

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## ON THE SUPPORTS OF THE UTERUS

HARRY KOSTER, M.D., F.A.C.S., BROOKLYN, N. Y.

A CRITICAL review of the value of the ligaments as supporting structures to the uterus must result in the conclusion that they cannot be very effectual. This is especially true of the round ligaments, because at laparotomy it is seen that the uterus can easily be retroverted without any strain on the former and that the return of the uterus to its normal position upon the release of the retroverting strain is not due to their pull. This was well demonstrated in experiments performed by Maekenrodt<sup>4</sup> in which he resected a piece of both round ligaments near their attachment to the uterus in a manner to prevent the subsequent union of the separated muscular ends. He then retroverted the uterus and packed the intestines on its anterior surface, after which the abdomen was quickly closed. When the uneventfully recovered patient was discharged, he found that the uterus was in a normal position, even though during the convalescence the patient had been lying on her back, and of course, no longer had an intact round ligament to hold the uterus upward. The history of the end-result of round ligament operations for the cure of prolapse is also eloquent testimony of the ineffectiveness of these structures to support the uterus. The peritoneal folds forming the broad ligaments, because of their very structure, are not worthy of any consideration as uterine supports. The uterosacral ligaments composed of material similar to the round ligaments are of no more value as supporting structures than are the round ligaments. The only other structure possibly capable of supporting the uterus is the uteropelvic ligament, the Maekenrodt ligament, the cardinal ligament, or the infundibulopelvic ligament, as this structure has been variously called. Maekenrodt, in the examination of the fascia endopelvina (that portion lying over the levator ani and directly under the peritoneum) in a newborn, reported thick, bandlike fibers running directly to the vagina, rectum, and bladder in which were muscular elements. Dorsally, he found a mass of these fibers arranged like a band in the border of the broad ligament, but distinctly separate from it, running from the pelvic fascia into the cervix. This he designated the ligamentum transversum colli, and claimed for it the sole support of the uterus. According to him, in the fetus and newborn, it runs from near the last lumbar vertebra downward toward the side wall of the cervix to which it is attached. As the ilia develop, the ligament moves farther away laterally from the vertebral column, until it finally comes to lie in the transverse diameter of the pelvis. At its upper border runs the uterine artery.

He also described other bands of musculofascial fibers. One set of these forms the uterosacral ligaments and the other set the pubovesico-



uterine ligaments which latter run from the attachment of the ligamentum transversum colli to the cervix along the side wall of the bladder to the hind wall of the symphysis. Still other bands run out into the rectovaginal and vesicovaginal septae, offering strong supports to the rectum and bladder and serving to close the pelvic floor aperture. All of these bands are attached through the ligamentum transversum colli to the uterus which is the pivotal supporting structure. These bands hold up the bladder and other pelvic organs.

These statements have been accepted for face value quite generally without being corroborated by investigation.

The adoption of original contributions as the fundamental basis for further work without research into the former for confirmation has been one of the greatest obstacles scientific progress has had to contend with.

In this instance the adoption of Mackenrodt's view has resulted not only in the development of a nomenclature but also in the elaboration of hypotheses regarding the mechanism of prolapse, cystocele, and rectocele. Many operations were developed for the cure of these conditions, adopting as fundamental, the existence of these ligaments and fascia as Mackenrodt described them. Thus it is quite common to hear operators speak of "operations for the correction of prolapse, cystocele, and rectocele, including the plication of rectovaginal fascia, vesicovaginal fascia, 'Mackenrodt's' ligaments, etc."

In 1910 Blair Bell<sup>2</sup> taught that the pelvic fascia instead of being a very complicated structure with a great many diverticuli accessory to the main portion, consisted of simply a fibrous tissue investiture forming the sheath of and giving attachment to, the various muscles of the pelvic floor. Unfortunately however, his teachings did not receive the wide recognition that they deserved. Quoting from him, "Care must be taken that the separation is effected in the plane between the bladder wall and the muscle and fascia underlying the vaginal mucosa, not only in order that the separation may be easy but also that the muscle and fascia may be sutured together subsequently." This appears in the discussion on the technic of anterior colporrhaphy. Spaulding<sup>3</sup> in the AMERICAN JOURNAL OF OBSTETRICS AND GYNECOLOGY, writing on hemostasis in vaginal hysterectomy presents photomicrographs of tissue between the bladder and anterior wall of the vagina, in which he very definitely speaks of a vesicovaginal fascia.

Recently Goff,<sup>4</sup> in an histologic study of the perivaginal fascia in a nullipara concludes that (1) there is no fascia of any kind in the walls of the vagina, urethra, bladder, or rectum; (2) there is no fascia between the anterior vaginal wall and the urethral wall; (3) there is a loose areolar fascia between the vagina and bladder and between the vagina and rectum not dissectable as a distinct layer; (4) this is the only fascia available to accord with the descriptions of fascia used in various operative procedures for the cure of cystocele and rectocele; (5) this "fascia" is not at all comparable with the dense fascia such as forms the sheath of the rectus abdominis.

In Goff's very interesting article, he states that a careful search through the literature had failed to reveal any previous attempt at a study of a similar nature with the exception of that by Spaulding on sections from the vesicovaginal septum in which the latter failed to state whether the

subject from whom the material was taken was nulliparous or multiparous. It would seem that the more important point to make was that Spaulding disagreed with Goff's findings, inasmuch as he stated very definitely that there was a vesicovaginal fascia of a well defined character which he utilized in the performance of a certain portion of the operation of vaginal hysterectomy. To us it seems that the question of multipara or nullipara is of importance in the direction opposite to that taken by Goff, inasmuch as the practical value of any fascia in the vesicovaginal or rectovaginal septum, if such existed, would be found in its utilization in operations in multiparous women for repair of pelvic floor injuries. In other words if there was any such fascia existent, it would be much more important to find this in a multiparous individual who needed perineal reparative work than in a nulliparous woman who needed no operative procedure.

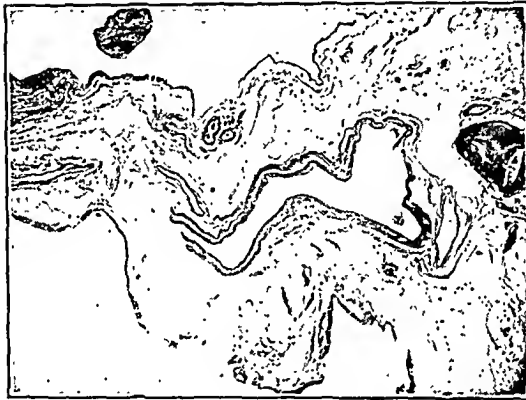


Fig. 1.—Fibrous tissue along the junction of cervix and uterine body in which is seen a longitudinal section of the uterine vein and a cross-section of the uterine artery just before it turns to course along side of the uterus. There is no ligamentous or fascial structure in this loose areolar connective tissue.

Dougal Bissell<sup>1</sup> in an article entitled "Fascial lapping as applied to the tissues of the vaginal wall, a misnomer" states that in cases of vaginal prolapse there is no definite fascial layer of the vaginal wall which can be isolated and used surgically to advantage. He presents photomicrographs of a section of tissue removed from the left side of the anterior vaginal wall. His conclusions are open to the criticism that the section of tissue which he examined was not a complete section of the vesicovaginal septum and that in the tissue remaining in the septum and not excised for examination, fascial tissue might have existed.

In our studies on the mechanism of the development of prolapse, among other things, we examined the structure of the vesicovaginal and rectovaginal septa.

Microscopic examination of sections of the vesicovaginal septum and the rectovaginal septum in autopsy material in a multiparous woman, showed no evidence of existence of any fascial structure comparable to that de-

scribed in any of the texts, in other words our findings are in thorough accord with the findings of Goff in his nulliparous material. In our operative material we have never been able to demonstrate any fascia in the rectovaginal or vesicovaginal septa. The only tissue to be found there, other than the mucosa is a loose, areolar connective tissue which can have no restraining or supportive value. Where then are those dense musculo-fibrous bands coming from the attachment of the ligamentum transversum colli or uteropelvic ligament as others call it, and spreading out through the vesicovaginal and rectovaginal septi of which Mackenrodt wrote?

In a similar set of studies made on autopsy material we investigated the tissue around the uterine arteries in their course from the internal iliae to the uterus in search for the so-called Mackenrodt ligament, and here again we met with negative results.



Fig. 2.—Cross section of the uterine artery, a longitudinal section of the uterine vein and a cross-section of two of its larger tributaries, and also a cross-section of the ureter with surrounding loose areolar connective tissue but no ligamentous or fascial tissue.

#### METHOD

The uterus, adnexa, bladder, vagina, and urethra and all the loose areolar connective tissue making up the parametrium were excised from a multiparous female patient, thirty-one years of age with no sign of prolapse or retrodisplacement of the uterus, and the entire mass was fixed in formalin for a week. Then sections were made of the rectovaginal septum and the vesicovaginal septum. A section was made longitudinally parallel to the uterine artery as it coursed along the uterus, beginning at the round ligament and extending downward as far as the junction of the vagina with the cervix, taking in a portion of the bladder wall and making a transsection through the uterine artery after it had curved away from the uterus out toward the lateral pelvic wall. This section contained all the loose cellular and fibrous tissue around the junction of the cervix in the body and should have included the so-called Mackenrodt ligament. Other sections were then taken lateral to this one at distances of  $\frac{1}{2}$  cm. transversely across the uterine artery and all its surrounding cellular and fibrous tissue, so that any ligament running from the uterus toward the lateral pelvic wall would be caught and transsected by these sections. Similar sections were also

taken from operating room material after operations of complete hysterectomy. All of these sections were stained by the Van Gieson differential method (by means of which fibrous and muscle tissue are easily distinguished).

In the section of the rectovaginal septum, beginning at the upper end and running down to the perineum, the vaginal wall is separated from the rectum only by loose areolar connective tissue. Nowhere in this septum was there any fascial tissue.

In the section through the vesicovaginal septum in the median line, the wall of the bladder is separated from the cervix and vagina by a loose areolar connective tissue in which nerve bundles and blood vessels can be seen, but there is no evidence of any fascia. Since these findings offer nothing new but are merely confirmatory of Goff's results no illustrations are presented.

Fig. 1 shows the tissue in a longitudinal section of the left side of the uterine artery as it courses along the uterus. Here can be seen the cellular and fibrous tissue along the junction of the cervix and body, a longitudinal portion of the uterine vein and a cross-section of the uterine artery just as it turns up to course along side of the uterus.



Fig. 3.—Ureter, uterine artery and vein in cross-sections embedded in loose areolar tissue.

These vessels are surrounded by a loose areolar connective tissue with no sign of a distinct fascial or ligamentous structure.

Fig. 2 taken from a section 1 cm. lateral to the previous figure shows a cross-section of the uterine artery, a longitudinal section of the uterine vein and a cross-section of two of its larger tributaries and also a cross-section of the ureter all surrounded by loose areolar connective tissue with no fascia or ligamentous tissue.

Fig. 3 shows the section taken  $\frac{1}{2}$  cm. further lateral with the ureter, artery, and vein in cross-section. All are completely imbedded in loose areolar tissue. Near the artery is a vein partially closed with calcareous deposit around which a layer of muscle and fibrous tissue which is a tangential section. There is no sign of any ligament.

Fig. 4 shows a transverse section through the parametrium just above the vagina and lateral to the uterus. In the center is the ureter; on one side is the vein and on the other side is the artery cut across twice because of tortuosity. At one side of the section is a wall of the broad ligament. There is considerable loose areolar connective tissue and fat tissue all around the vessels but no ligament or fascial structure.

Fig. 5 is a section of the broad ligament taken parallel to the lateral wall of the uterus. It shows the vessels of the tube at one end, the round ligament near the middle and the uterine vessels at the other end, with considerable fat tissue but no sign of fascial structure or ligament.

Examination of cross sections of parametrium adjoining the junction of the uterine body and cervix through which coursed the uterine vessels taken from operative material obtained from cases where total hysterectomy was performed corroborated the findings in the autopsy material. Nowhere in the tissue around the uterine vessels as they approached or reached the uterus, was any ligamentous tissue found.



Fig. 4.—Further lateral with ureter and vessels but no uteropelvic ligament.



Fig. 5.—Section of broad ligament parallel to the lateral wall of the uterus showing the round ligament and uterine vessels but no fascial structure or ligament.

#### COMMENT

Microscopically, there is no well formed, dense, fascial tissue in either the rectovaginal or vesicovaginal septum. The tissue separating the rectal from the vaginal, and the vesical from the vaginal walls is a loose, areolar connective tissue. The tissue, because of its character and composition, could have no restraining action in the prevention of either rectocele or cystocele and could also have no value in the repair of such conditions.

Macroscopically, in the adult, there is no tissue found in the neighborhood of the uterine artery extending from the uterus at the junction of

the cervix in the body outward toward the lateral wall of the pelvis, which is at all comparable to the ligamentous structure known as the cardinal ligament.

Microscopically, in the adult, there is no such tissue demonstrable. That the round ligament could not be the only mechanism by means of which the uterus was kept in its normal position is certainly generally accepted by now. Were there a similar ligamentous structure attached to the uterus at the junction of the body and cervix and to the lateral pelvic wall it would still remain to be shown that it was the only or even an important factor in the maintenance of the normal position of the uterus. According to our histologic studies however, no such tissue is available for the support of the uterus, either as a distinct ligament or distinct fascia. The only tissues found in that neighborhood were loose areolar connective tissue and fat. Thus, the prominence given to the uteropelvic or infundibulopelvic or Maekenrodt ligaments as supports of the uterus is unwarranted. Not only is there no such ligamentous tissue but the prominence given to these ligaments as supporting structures to the uterus, is totally unwarranted. It is interesting to note in this connection that in Piersol's and Gray's anatomy, under the heading of uterine support, mention is made only of the round, broad, and uterosacral ligaments.

It also becomes manifest then that the operations for the cure of prolapse by plication or shortening of the cardinal or Maekenrodt ligament as advocated by Nyulasy<sup>5</sup> have no rational basis.

Also in proposing a rational explanation for the development of prolapse, and its cure, these so-called ligaments must be excluded from consideration.

#### CONCLUSION

There is no ligamentous tissue, which might by its presence be able to support the uterus, to be found in the base of the broad ligament around or near the uterine vessels and extending from the uterus out to the lateral pelvic wall as described in some texts under the name of Maekenrodt ligament, the cardinal ligament, the uteropelvic ligament or the infundibulopelvic ligament. The name ligament attached to any structure existing in the base of the broad ligament and surrounding or near the uterine vessels, extending from the cervix out to the lateral pelvic wall is a misnomer and is distinctly misleading. The uterus cannot depend for support on any structure to be found in the base of the broad ligament, running from the cervix out to the lateral pelvic wall and previously designated as the Maekenrodt, the cardinal, the uteropelvic or the infundibulopelvic ligament any more than it can on any and all the tissues to which it is attached. The explanation of the development of prolapse and its cure, can no longer include a consideration of these so-called ligaments. Operations designed for the cure of prolapse of the uterus by shortening the so-called cardinal, Maekenrodt, uteropelvic or infundibulopelvic ligaments have no rational basis.

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## INTERNAL ROTATION OF THE FETAL HEAD FROM THE VIEWPOINT OF COMPARATIVE OBSTETRICS\*

LOUIS RUDOLPH, M.S., M.D., F.A.C.S., AND A. C. IVY, PH.D., M.D.,  
CHICAGO, ILL.

(From the Department of Physiology and Pharmacology, Northwestern  
University Medical School)

THE scientific investigation of the mechanism of labor began with Woulf in 1742<sup>1</sup> when he observed that the fetal head entered the pelvic excavation with the sagittal suture in the transverse diameter. The prevailing theory at that time was that the fetal head entered and passed through the pelvic excavation with the sagittal suture in the anteroposterior diameter, appearing as if the child crept into the world. Saxtorph<sup>2</sup> and Solaryes<sup>3</sup> threw more light on this question by their observation that the fetal head entered the pelvic excavation with the sagittal suture in one of the oblique diameters, a view supported by Baudelocque<sup>4</sup> and Naegele<sup>5</sup> and now generally accepted by the profession. Levret<sup>6</sup> in 1762 emphasized the importance of the mechanical factor in labor thus giving rise to the so-called obstetrico-mathematical school which was to influence later obstetric thought. Rigby<sup>7</sup> in 1841, realizing the mechanical trend of obstetric thought, wrote, "In the last century, it was so the fashion to resolve every physiologic process into a mathematical problem." Our studies of the physiology of the uterus in labor<sup>8, 9</sup> have caused us to inquire into the mechanism of the internal anterior rotation of the fetal head. These studies have led us to the conclusion that the uterus plays an important rôle in rotating the fetus, particularly in lower animals.

A review of the literature will demonstrate that internal rotation of the fetal head appears to be based, in the main, upon the mechanical factors of the pelvis. On the contrary, a number of writers have presented evidence that the uterus, or even the fetus, is or may be a factor. No attempt will be made at this time to review the evidence *pro* and *con* and to discuss the various theories. However, having made such a review, we are of the opinion that the teaching of Denman<sup>10</sup> and Rigby,<sup>7</sup> which maintains that the adaptation to and propulsion of the fetus through the pelvic cavity is only a mechanical incident resulting from a physiologic process, has not been sufficiently appreciated.

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It occurred to us that a study of comparative obstetrics or the phylogenetic history of pregnancy and parturition might throw some light on the subject. We shall briefly outline the evolution of the pelvis, the physiology of the uterus in labor in vertebrates, and record the observations we have made on internal rotation of the fetus in the parturient dog, pointing out that due to morphologic changes in the pelvis, the uterus accommodates its function accordingly.

#### THE PELVIS

In the following brief review of the comparative anatomy of the pelvis,<sup>11 to 23</sup> it will be noted that as the progenitors of man became more erect, the architecture of the pelvis changed to meet the requirements best suited to subserve the function required by the orthograde posture.



Fig. 1.—Photograph of the lateral and posterior views of the pelvis of the chicken.

In the fish, the primary requirement for existence is locomotion, so that Nature has provided the spinal column for that purpose. The caudal vertebrae are particularly mobile and not hampered by a definite pelvic girdle to hinder the mechanism of propulsion. Here we find the first rudimentary indication of a pelvis consisting of two calcified or evenly ossified pelvic plates which become segmented from the basal cartilage and are held in place by either a cartilaginous or a ligamentous attachment.

In birds, we come to a group whose existence is dependent both on flight and on the ability to use the hind limbs for locomotion on land. The exception to the rule is presented by the South African ostrich which has a well formed pelvis and depends on its hind limbs for locomotion in flight. The vertebral column is semirigid and the pelvis is designed to support the hind limbs. The pelvis is developed more dorsally than ventrally. It is fixed posteriorly to the lateral part of the sacrum. Anteriorly the two halves of the pelvis are separated from each other, but are connected by either a cartilaginous or ligamentous attachment, which completes the pelvic girdle (Fig. 1). In fish and in birds, the pelvic aperture is large in comparison to the eggs that must pass through, so that in the expulsion they do not meet with much mechanical resistance.



The pelvis of the mammal is firmly attached to the vertebral column and there exists a union of the pubes and ischium anteriorly in the midline to form a symphysis. By gradual stages, the ischium spreads laterally from the ischiopubic symphysis, forming the pelvic arch, which is clearly demonstrated by a study of the dry pelvis of the mammal (Fig. 2).

A study of the pelvis of the monotremes, marsupials, rodents, ungulates, carnivores, and the monkeys demonstrates that the symphysis is quite long, and that the ischiopubic arch varies.

In the anthropoid apes and in man, we note a radical change from the lower mammals in that the ischiopubic symphysis changes. The symphysis becomes shorter and the pubic arch greater, reaching its greatest relative shortness and forming the greatest pelvic arch in man (Fig. 2). Schumann<sup>17</sup> points out that in the lower animals the ischiopubic symphysis is approximately one-half of the pelvic length. The infantile human pelvis is like that of a quadruped pelvis in that its anteroposterior diameter is greater than the transverse and is quite similar to that of the highest apes. This change in the morphology and length of the symphysis is related to the evolution in the mode of the mechanism of labor of all vertebrates in that the diameters of the pelvic inlet in relation to the fully developed fetus play a rôle in determining the position of the presenting part for physiologic birth. For a complete review, the reader is referred to Schumann.<sup>17</sup>

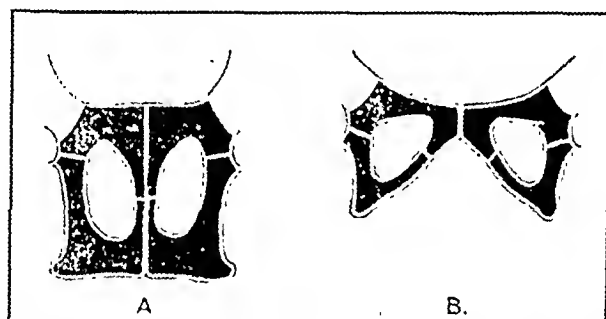


Fig. 2.—Diagrammatic representations of (A) the primitive mammalian and (B) the human type of ventral symphysis. (Taken from Jones, *Arboreal Man*.)

### PARTURITION

In fish, most of which are oviparous, the ova are stored in an ovaries which is part of the coelomic cavity. Spawning is brought about by abdominal contractions and the unfertilized ova pass out through the abdominal pores. The shark-like fish (*Elasmobranchii*)<sup>24, 25</sup> are ovoviviparous and oviparous. The eggs are fertilized in the oviducts and develop in the uterine enlargements of the ducts. In the shark-like fish which are viviparous, we must assume that the fetus or fetuses at term are expelled from the uterus by a mechanism of parturition consisting of a relaxation of the genital openings, and of abdominal and uterine contractions.

In birds which are oviparous, we find that the anatomy and the physiology of parturition are closely allied to the higher mammals. Verrier<sup>26</sup> in 1884 compared the normal parturition in the human being to the rotation of the egg within the oviduct of oviparous (birds) animals before its exit. The müllerian ducts, one on each side of the vertebral column, form the oviducts. At maturity, the right oviduct and ovary atrophy. After the ripening of the yolk, it enters the ostium abdominale tubae of the left oviduct, passing down through the oviduct in a spiral rotatory manner on its chazal axis due to peristaltic activity. The musculature of the oviduct is spirally arranged. During the descent of the egg, the albuminous layer is deposited in spiral coats. The shell membrane is laid on in the uterus.

The egg passes down the oviduct with the pointed end first.<sup>27 to 33</sup> Aristotle<sup>34</sup> wrote that the blunt end of the egg is laid first. This has been confirmed.<sup>35 to 38</sup> Due to the work of Wickman,<sup>31</sup> it appears to be settled that the egg passes down the oviduct with the pointed end first, but that in the expulsion of the egg from the shell-gland or uterus, it is turned usually 180 degrees on its short axis to be deposited externally with the blunt end first. That is, the egg undergoes a "version of 180 degrees" usually before or during the delivery of the egg.

The mechanism of the delivery of the egg: From the uterus or shell-gland the egg is emptied into the cloaca by the relaxation of a strong sphincter at the lower pole of the uterus and peristalsis of the uterus. The expulsion of the egg from the cloaca is accomplished by a mechanism of eversion of the cloaca, or, the uterus still enveloping the egg is prolapsed through the cloaca and the vagina and the egg is laid without having touched the walls of either the cloaca or the vagina.<sup>23</sup>

The pelvis is very probably a mechanical hindrance to the physiologic function of the uterus and is not essential for parturition in certain lower forms. This is indicated by a study of the shark-like fish (*Elasmobranchii*), the whale (*Cetacea*),<sup>39 to 43</sup> and the seal, sea lion and walrus (*aquatic carnivora*) which have only a rudimentary pelvis and are viviparous. In the shark-like fish, labor must be dependent upon the uterine and abdominal contractions. In the whale and in the seal, sea lion and walrus, the uterus is bicornate, so the mechanism of labor should be the same theoretically as occurs in those terrestrial animals which have a uterus bicornis. Since they have only a rudimentary pelvis, the pelvis is not essential for parturition in these animals which possess a uterus intermediate in differentiation.

In the monotremes, the two müllerian ducts become the two uteri. Each opens into the urogenital sinus on its respective side. These animals are egg-laying mammals, and we may assume that the mechanism of egg-laying is similar to the birds. How they are propelled through the urogenital sinus and the cloaca, we have been unable to determine.

In the marsupials, the two müllerian ducts become the two uteri which fuse just before reaching the urogenital sinus. The fused portion becomes the vagina, which opens almost immediately into the cloaca. These animals are egg-laying mammals and we assume that the fertilized ovum is propelled downwards through the uterus and through the cloaca to the vulva in the same manner as in the bird. Parturition takes place with the fetus in a premature state in the egg, which is arrested at the vulva, where the shell membrane ruptures. The fetus reaches the marsupia by its own locomotion and becomes fixed to a teat of the mammary gland.<sup>44</sup>

From the rodents to man, we reach a stage in the evolution of the uterus and parturition on the basis of which we may correlate homology and physiology.

In the uterus didelphys, uterus bicornis and the uterus simplex, we find certain outstanding structural and functional analogies as follows: The upper uterine segment which has the property of isometric contraction and retraction, manifests powerful peristaltoid contractions. The lower uterine segment with its property of relaxing, stretching or thinning manifests "less powerful" peristaltoid contractions. In addition, we find the presence of the "Ring of Bandl" (fundal sphincters) between the upper (cornua) and the lower (corpus uteri) uterine segments, and its correlated physiologic properties; the cervix uteri with its cervical canal, os internum and os externum and the similarity of its functions, being plugged during the pregnant state by mucus; and that during the second stage of labor, the uterus is assisted in the expulsion of the contained ovoid by the auxiliary forces.

In the rodents, the uteri are perfectly formed, each with a well-formed cervix, separated from each other, but opening into a single vagina (uterus didelphys). During labor, one of the lowermost ampullae of one uterus becomes active, divides into an upper and a lower uterine segment, and manifests a mechanism of labor that is similar to other mammals. The fetuses are expelled normally in a dorsosacral position. The lower

uterine segment is derived from the lowermost ampulla of each uterus and is the common lower uterine segment for the expulsion of each successive fetus from each respective uterus.<sup>45</sup> The upper uterine segment is derived from the upper part of the lowermost ampulla by retraction and a sustained longitudinal contraction. After the expulsion of the first fetus that part of the upper uterine segment merges with the ampullae above by retraction, and becomes in part the upper uterine segment for the mechanism of expulsion of each successive fetus from that uterus. This merging of the ampullae goes on until all of the fetuses are expelled. This physiology of the uterus of the rodent (rabbit) in labor will be published in more detail in a future publication.

In the carnivores, we have the formation of the uterus bicornis unicollis. The two müllerian ducts fuse into a single tube at the lower or caudal extremities to become the corpus uteri or the lower uterine segment, with one cervix opening into a single vagina; the upper or the cephalic extremities remain separated to form the cornua or horns, which are quite long. We have studied the physiology of labor in the dog,<sup>5</sup> and we will briefly review the first and second stages of labor. The first stage is the expulsion of the lowermost fetus from one of the lowermost ampullae. The corresponding fundal sphincter (Ring of Bandl) relaxes, and by retraction of the musculature of that ampulla the fetus is expelled into the corpus uteri. The second stage begins with a fetus in the corpus uteri when the relaxed fundal sphincter contracts, while the other sphincter holds it tone; and contractions of the corpus uteri aided by the auxiliary forces bring about the expulsion of the fetus. The mechanism of the cervix is probably the same as in the human being, but whether the dilatation occurs during the expulsion of the fetus from the cornu or after the fetus has entered the corpus uteri is as yet not known.

In the ungulates, the same anatomical arrangement is found as in the carnivores, except that the cornua or horns are relatively much shorter and the cervix is much more developed. During pregnancy, the fetus or fetuses are developed in the cornu, or cornua in the case of twins, and the corpus uteri. We have studied the physiology of the uterus in the sheep in labor, and in pregnant uteri of the cow in various stages during pregnancy. With the onset of labor, the pregnant cornu with each uterine contraction shortens by its property of retraction and pulls upward on the fundal sphincter. The continued shortening of the cornu or the upper uterine segment has the effect on the corpus uteri or the lower uterine segment of stretching or thinning it. This we believe brings about some cervical effacement and dilatation, which is further amplified by the presenting portion of the fetus in the corpus uteri. With the dilatation completed, the contraction of the cornu brings about expulsion of the fetus aided by the auxiliary forces.

In the primates, we find a complete fusion of the upper and the lower portions of the müllerian ducts forming a uterus simplex or arcuatus with a cervix which opens into a single vagina. Ivy, Hartman and Koff<sup>46</sup> have studied the physiology of the uterus in labor in the macacus rhesus and have pointed out certain homologies and analogies between the uterus of the monkey, dog, and man. It is known and can be demonstrated that the fetal head enters the pelvic cavity with the head in complete extension, the fetus being delivered in a position similar to the rodent, dog and mare, that is, in a dorso-sacral position. A study of the monkey's pelvis demonstrates its similarity to that of the carnivores and ungulates, except that the promontory of the sacrum is more marked in the monkey. A study of the fetal skull and maternal pelvis in the monkey shows that the head must pass through the pelvic cavity in extension in a dorso-sacral position. During pregnancy, Hartman<sup>47</sup> has found that the back of the monkey fetus is to the right or left side of the mother's abdomen.

In the anthropoid apes, the literature of the mechanism of labor is very meager. Fox<sup>48</sup> has described labor in a chimpanzee with the head delivering as an occipitoposterior. After the delivery, the face rotated to the left. Tinklepangh<sup>49</sup> described a portion

of parturition in a chimpanzee (during labor the chimpanzee became frightened and jumped onto a screen partition, and in the jump the fetus was expelled). Five days before the delivery, the position of the fetus was O.L.A. Just before the animal jumped, the head appeared at the vulva with the sagittal suture in the anteroposterior diameter, and the occiput posterior. From a comparative study of the dry pelvis and the skull of the anthropoid apes, it would appear that the fetal head should be delivered as in the human being, through the pelvic cavity by internal anterior rotation, because the transverse diameter is greater than the anteroposterior diameter of the pelvic inlet.

### INTERNAL ROTATION

The position of the fetus in utero during pregnancy and labor in the ungulates will be presented in order to emphasize the type of internal rotation that occurs. We will study the mare (Ruminantia).<sup>50</sup> to 55

During pregnancy, the fetus or foal lies usually in one of the cornua and the corpus uteri on its back on the floor of the mare's abdomen with the head towards the pelvic inlet and the hind end in the upper end of the gravid horn. The fetal chin is on the chest, the fore legs bent at the knee, and the hind legs flexed. This is the dorsopubic position (Fig. 3). The foal may lie on its side or in the dorsoliac position (Fig. 4). Williams<sup>50</sup> has recently found that the dorsopubic position is not the only prenatal position of the foal, since he and his associates have found by rectal palpation that the foal may lie either in a dorsoliac or a dorsosacral position. A roentgen study has not been made. The presentation is anterior or cephalic in from 95 to 96 per cent.<sup>50</sup>

A study of the pelvis and the fetal head of the mare, cow, and sheep demonstrates that the physiologic relations between the diameters of the pelvis and the presenting part of the fetus are such that in the mechanism of labor the fetus must rotate frequently from 90 to 180 degrees, or from the dorsoliac or the dorsopubic position, in order to reach the normal presentation and position of a cephalic dorsosacral position for physiologic birth (Fig. 5). In a hind end or breech presentation and position, the foal must be with the back to the maternal back with the hind legs fully extended which is a posterior or breech dorsosacral position. This rotation occurs preparatory to birth or during the first stage of labor. The presentation undergoes changes in which the fore legs and head are extended; the vertex is in relation to the hollow of the sacrum, and the chin and the anterior portion of the neck are in relation to the ischiopubic symphysis. As the head is being delivered, restitution begins to occur, which is flexion of the head or a return to the position in which the head was prior to labor. It is to be noted that when effacement and dilatation of the cervix are completed, and the foal is in position for delivery, it must ascend about 45 degrees in order to pass over the ischiopubic symphysis and through the pelvic inlet.

We may add, at this time, that the component parts of the mare's uterus may be compared to the human uterus at this stage. The pregnant cornu is analogous to the upper uterine segment. The corpus uteri and the cervix are analogous to the lower uterine segment and the cervix. At the junction of the cornua and the corpus uteri is found a definite sphincter-like structure which we call the fundal sphincter, similarly to the structure found in the dog,<sup>5</sup> which is analogous, we believe, to the "Ring of Bandl." During labor, the nonpregnant cornu, which has also undergone hypertrophy, is kept closed by an isometric contraction of its corresponding fundal sphincter which prevents the foal from entering the nonpregnant cornu. The veterinarian literature states that the nongravid horn is kept closed and prevents the foal from entering on account of a synchronous contraction with the active gravid cornu; (we believe that the nongravid horn is to be considered more or less passive during parturition).

With the foal in a normal presentation and position, the expulsion of the animal is brought about by the uterine activity of three types: (a) contraction, (b) "isometric

shortening" of the longitudinal muscles with retraction of the horn, and (c) stretching and relaxation of the corpus uteri with effacement and dilatation of the cervix. The horn thickens or "caps" due to the isometric contraction or the sustained contraction of the longitudinal musculature. The corpus uteri by relaxing and being

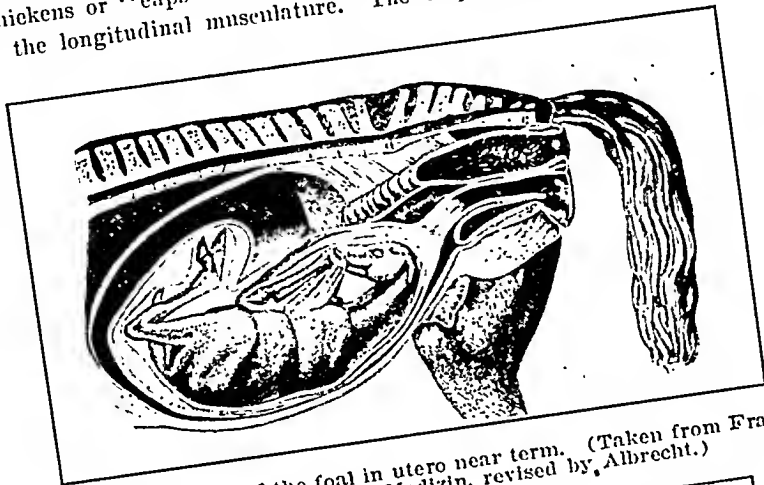


Fig. 3.—Shows the position of the foal in utero near term. (Taken from Franck, Handbuch der Tierärztlichen Medizin, revised by Albrecht.)

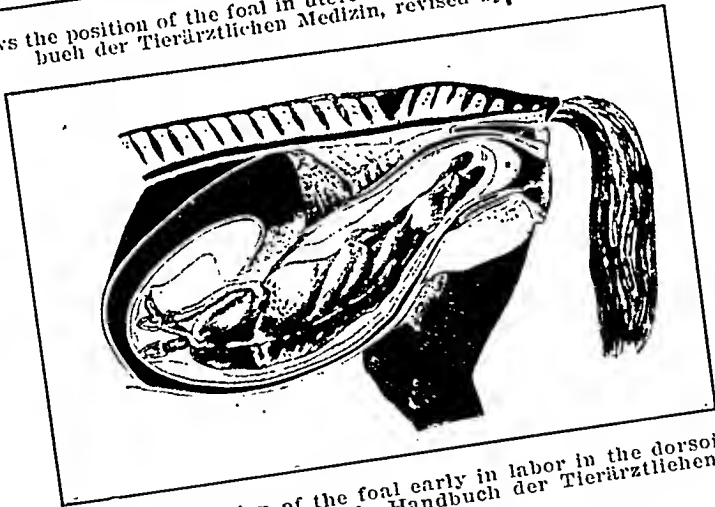


Fig. 4.—Shows the position of the foal early in labor in the dorsoiliac position, partial rotation. (Taken from Franck, Handbuch der Tierärztlichen Medizin, revised by Albrecht.)

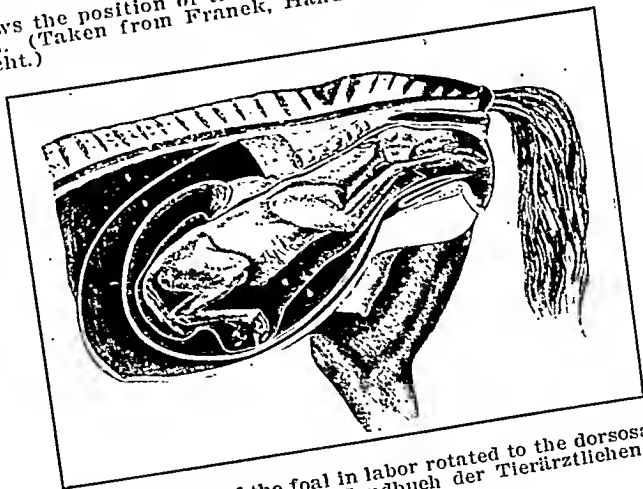


Fig. 5.—Shows the position of the foal in labor rotated to the dorsosacral position for physiologic birth. (Taken from Franck, Handbuch der Tierärztlichen Medizin, revised by Albrecht.)

stretched bring about effacement and dilatation of the cervix along with relaxation of the smooth muscle forming the cervical sphincter.

A consideration of the anatomy of the pelvis and the uterus in the mare, and the changes of the foal on its longitudinal axis excites the query, what causes the rotation of the foal? Smith<sup>54</sup> and de Bruin<sup>52</sup> state that the uterine contractions cause the foal to be rotated on its longitudinal axis; and that the extension of the fore legs is due to

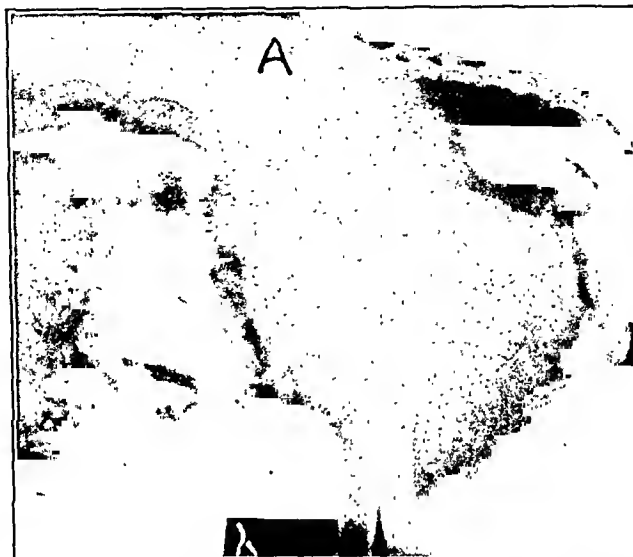


Fig. 6.—A.—A roentgenogram of a dog in labor. The head is entering the corpus uteri in a cephalic dorsopubic position. The body is approximately in a dorsoiliac position.

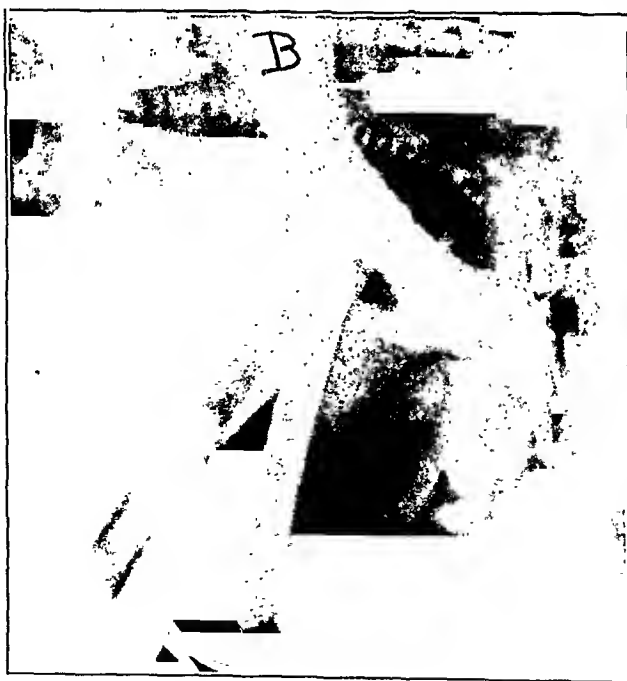


Fig. 6.—B.—A roentgenogram of the same dog as in Fig. 6-A with the head and body rotated to a dorsosacral position, the head being at the outlet. Similar rotation may occur before the head passes the inlet.

the result of the fetal movements. The gravid horn is so placed that the angle between the axis of the gravid horn and pelvic axis is about 45 degrees. The resistance that the presenting part meets occurs only during the duration of the uterine contractions. In the interval between the uterine contractions, we can readily see that by gravity and relaxation of the uterus the foal would tend to lose its contact with the bony pelvic inlet. Recalling the above outlined changes of the position of the foal, we note that the inclined planes, the ischial spines, and the pelvic floor of the mare take no part in aiding or bringing about internal rotation of the foal on its longitudinal axis. Since the pelvic inlet cannot account for the rotation, and since we cannot believe that the fetus crawls into position, we must accept the premise that the uterine contractions are responsible for the rotation of the foal into a normal presentation and position for the physiologic birth.

Because of the similarity of the pelvis and the uterus between the ungulates and the carnivores, we undertook a roentgenographic study in the dog to determine the position of the fetuses during pregnancy and parturition.

Roentgenograms of pregnant dogs from thirty days to near term were made. On the onset of labor or after one or more pups had been delivered, roentgenograms were taken at intervals, or in series. By direct observation, we have also determined under anesthesia with the abdomen open, the presentation and position in which the pups were delivered. A majority of the deliveries were studied by vaginal examinations during the passage of the pups through the pelvic cavity, the findings being correlated with the x-ray plates. No anesthesia was required. All dogs cooperated remarkably well. The roentgenograms were taken in three positions: lateral with the dog lying on the plate; lateral with the dog standing on all fours with the plate held in position by a specially constructed, adjustable plate holder; on its back with the fore and hind legs held apart on a plate. We found that the most practical position was with the dog lying on its side. Roentgenograms show that this position does not cause a material change in the position of the fetuses. Fourteen dogs were studied during pregnancy and labor.

During pregnancy, the roentgenograms showed that the majority of the pups in the horns are in a dorsopubic position, with some in a dorsosacral position, and others in a transverse position. The transverse position is due to the marked enlargement of the horns which become somewhat flexed on themselves, so that an "apparent" transverse position is found on the roentgenogram.

NOTE: For lack of space the protocols of the experiments made in dogs cannot be included.

Our evidence shows that the presenting fetus not only rotates during its passage through the corpus uteri, but may rotate (but not always) to a dorsosacral position before it enters the pelvic inlet. Every one of the ninety pups whose birth was observed was delivered in a dorsosacral position. If the fetus enters the corpus uteri in an approximate dorsosacral position, very little rotation may result. "Superrotation" occurred in one instance. The fetus may enter the pelvic inlet in a dorsoiliac or dorsopubic position, but in such instances, rotation to a dorsosacral position occurred before birth.

The rotation to a dorsosacral position is practically complete as a rule before the fetus strikes the pelvic floor. The head is fully extended during passage through the corpus uteri. We could not decide from our

roentgenograms the direction of the rotation, or whether the direction depended on the horn from which the fetus passed. This is an important point because the direction of rotation may depend on the horn from which the fetus comes and which is turn may have some bearing on the direction of rotation of the fetal body in the human being.

The long labors were apparently due to abnormal positions caused by uterine dysfunction. It is interesting that one fetus may be delivered slowly and apparently with difficulty, and then the following fetus be delivered within a few minutes. This indicates that the disturbed function was temporary. The observed fact is that in the dog the fetus rotates during passage through the corpus uteri.

#### SUMMARIZING STUDY OF COMPARATIVE OBSTETRICS

A review of our knowledge of comparative obstetrics emphasizes the exceedingly interesting evolution of the morphology of the pelvis and the uterus and throws light on the physiology of the uterus. The gradual change of the pelvis from the fish to the human being demonstrates the relation of structure to functional activity. The change in the postural attitude from the pronograde to the orthograde was associated with a logical mechanical change in the architecture of the pelvic girdle.

The oviduct of the bird propels the yolk downward in a spiral manner to the shell gland or uterus, and "version" of the egg of 180 degrees on its short axis occurs<sup>33</sup> usually in its delivery. In the mare, the foal is rotated frequently from 90 to 180 degrees for physiologic birth in a dorso-saeral position or in the largest pelvic diameter. We have found in the dog that the fetus is rotated in some instances from 90 to 180 degrees for physiologic birth. This amount of rotation may or may not occur (usually does not) before the fetus enters the pelvic inlet, the amount of rotation varying with the position in which the fetus enters the corpus uteri. Most of the rotation occurs in the corpus uteri or just before the fetus enters the vagina. In this connection it is interesting that rupture of the uterus has been observed<sup>36</sup> in the dog due to impaction of the forepart of the fetus in the pelvic cavity in a dorsopubic position, which is analogous to impaction in the mentoposterior position in the human being. Hartman's<sup>57</sup> study of parturition in the monkey (*Macacus rhesus*) has demonstrated that the fetus is delivered in a dorso-saeral position with the head fully extended. It was found<sup>47</sup> by palpation that the back of the monkey fetus is found usually to the right or left side of the mother's abdomen. Our study of the monkey's pelvis has shown its similarity to the pelvis of the dog and mare in regard to the pelvic inlet and cavity, except that in the monkey, the promontory of the sacrum is more marked. And a study of the fetal skull and maternal pelvis shows that the only manner in which the head could pass through the pelvic cavity without meeting considerable obstruction or even impaction resulting, is in extension in a dorso-saeral position, the body following through. On the basis



of our studies, we must conclude that in lower animals the uterus is primarily responsible for placing the fetus in a dorsosacral position with head extended, the position in which is found the greatest pelvic diameter, for physiologic birth. The truth of this generalization was recognized by Schumann, who in speaking of rotation points out that it consists "not in rotation of the presenting part upon the pelvic floor, nor do the pelvic walls play an important rôle in this phenomenon," it being more of an accommodation of the greatest diameter of the fetus to the greater axis of the maternal pelvis.

#### CHIEF DIFFERENCE BETWEEN LOWER FORMS AND THE HUMAN BEING

In the apes, monkeys, and quadrupeds, the largest pelvic diameter throughout is anteroposterior, whereas in the adult human being at the inlet the largest diameter is transverse, the promontory of the sacrum being more marked. In these lower forms, the fetal head is delivered in extension, occipitoposterior (not definitely settled in apes), in the human being, occipitoanterior. In these animals and in the human being, the head is born in the anteroposterior, or largest diameter of the outlet, but with opposite positions of the occiput. In other words, the change in the diameter of the pelvic inlet has been associated with a change in the position of delivery of the occiput. This is a fundamental difference, since even in most occipitoposterior positions in the human being, anterior rotation occurs.

Another outstanding difference is in the position of the head during passage through the pelvis. In these lower forms, the head is in extension throughout, flexion occurring only after the chin has passed the ischiopubic symphysis. In the dog the head is extended during passage through the corpus uteri. In the human being, the opposite occurs; the head enters the pelvis slightly flexed, then flexion becomes very marked, deflexion occurring as the occiput passes the symphysis. The mechanism of delivery of a human fetus in a mentoanterior position is quite analogous to that of the dog.

Further difference is found in the curvature of the birth canal. In these lower forms, although the birth canal is curved anteriorly, it is less so than in the human being.

We maintain, on the basis of our observations, that there is no difference in regard to the snugness with which the fetus fits into the birth canal. However, a difference does exist in regard to the amount of obstruction met with at the level of the pelvic floor. In lower animals the fetus is usually rotated into the position of least resistance before it strikes the pelvic floor; whereas, in the human being this is not entirely true, since the pelvic floor does play some rôle in rotation.

Since the uterus of lower animals is apparently the chief factor which accommodates the fetus to the pelvic cavity for physiologic birth, the

questions arise, has the human uterus retained this phylogenetic property of rotating and adapting the fetal ovoid in relation to the morphologically changed pelvis, or as the morphology of the pelvis changed, did the fundamental physiology of the uterus change?

#### COMMENT

*In the Human Being.*—It is known that all hollow viscera have a normal shape and posture which are maintained primarily by the anatomical arrangement and tone of the muscle fibers. Changes in tone of the muscle fibers lead to changes in postural tone (length and tension of muscle fiber) of the organ, or the outline, contour and position of the contents of the viscus. Gravity affects the posture of a muscular viscus, particularly if the abdominal musculature is atonic; but obviously this means that the tone of the muscle of the viscus is insufficient to overcome the influence of gravity (ligamentous supports remaining constant). These facts are pointed out to indicate that the postural tone of the uterus is an important factor in determining the position of the fetus during the latter part of pregnancy and more particularly during labor except in cases of polyhydramnion. In cases of polyhydramnion that come to term, and in multiparae with a flaccid uterus and lax abdominal walls, it is known that malpresentations frequently occur.<sup>58</sup> In a previous article<sup>9</sup> we have presented evidence indicating that the uterus possesses a coordinating mechanism, which makes possible a purposeful and harmonious movement, a disturbance of which causes variations in muscular tone in different portions and may lead to abnormal positions, presentations, or prolonged labor. We maintain, therefore, that the postural tone of the uterine musculature which is, of course, markedly increased during contractions, is the basic factor concerned in determining the presentation and position. This is somewhat analogous to the view of Olshansen,<sup>59</sup> Schnitt,<sup>60</sup> which was accepted by Bumm<sup>61</sup> and others<sup>62 to 66</sup> which holds that in labor, "the uterus tends to assume its original flattened form," and is analogous to the "theory of accommodation," which with gravity, is used to explain the frequency of cephalic presentation.

Our contention is that as the transverse diameter of the human pelvis became the larger diameter, the uterus adapted its physiology to meet this change in morphology. It is difficult for us to believe that the fact that the sagittal suture enters most commonly either the oblique or transverse diameter of the pelvic inlet in man is a "mechanical accident," or that "Nature," in such an important process as birth, would rely solely on the possibility that force applied to the fetal ovoid would cause it to seek the larger opening, or that the "directing force" manifested by the uterus in lower animals has been lost entirely by the human uterus. However, we do not intend to imply that mechanical factors do not play a rôle in the causation of flexion, deflexion, and rotation.\*

\*It is not within the province of this paper to consider cephalopelvic disproportion.

In the dog, we have observed abnormal positions at the inlet. Although associated with prolonged labor, the abnormal position may be corrected in time by the uterus, or before the head has passed through the cervix, or much beyond the inlet. Analogously in the human being it is not uncommon to find the head in an abnormal presentation at term (x-ray), i. e., a brow, a mento or an intermediate presentation, and in the majority of cases the malpresentation is corrected spontaneously. Also in most cases of "deflexion attitude," spontaneous correction occurs. The question arises, is the uterus, or the mechanics of the pelvis, primarily concerned in the production and correction of such conditions?

In a previous paper we have expressed our conclusions in regard to malpresentations.<sup>9</sup>

In regard to deflexion attitudes, obstetric experience teaches that such a condition is associated with a dystocia syndrome characterized by prolonged labor, slow effacement and dilatation, lack of descent of the head, arrest, or slow rotation of the fetal head, and so-called inertia uteri. (We believe that inertia uteri is a condition in which the longitudinal and oblique muscle fibers of the upper segment do not manifest their important property in labor of isometric contraction, or sustained longitudinal shortening, which leads to retraction and "capping" and holds or fixes the progress or advantage gained by the preceding contractions.) The attitude of the head in the dog in labor is controlled by the same factors that operate in the human being, namely, a harmoniously contracting uterus throughout, the resistance to egress, and the classical unequally balanced two-armed lever that exists between the vertebral column (the support) and the head (a long and a short arm) (see Williams<sup>69</sup>). In order to get flexion of the head in the canine fetus, the snout would have to be lodged in a "paralyzed" pocket in the corpus uteri or caught in a pocket proximal to a bony protuberance. In cases of normal cephalopelvic relations in the human being, the uterus must be viewed as the primary cause of flexion because the force of the uterus, contracting uniformly in its various portions, is transmitted to the fetal spinal column. If the force transmitted through the fetal spinal column is misdirected by improper coordination of the upper uterine segment, or if the lower segment or cervix is more atonic or yielding in one portion than another, the lever action will be modified or abnormal. This may or may not be corrected by a resumption of normal uterine activity without which even the normally distributed resistances in the pelvic canal would be of no avail. This property of the uterus has been referred to by Solaryes<sup>68</sup> as the "reflected force" and by Winehell<sup>69</sup> as the "guiding line." Of course it is to be recognized that structural abnormalities in the pelvis, tumors, etc., may be the primary cause of deflexion.

That internal rotation is not a simple phenomenon is shown, first, by the large number of explanations that have been offered, and second, by

the fact that the head may be rotated either right or left depending on the position, and that during delivery the head may be rotated in one direction and then later the shoulders in the opposite direction. Most of the explanations offered are based entirely on mechanics. Only a few maintain that the uterus plays a primary rôle. Such a difference in opinion generally indicates that no single factor is concerned, as Cragin<sup>70</sup> has pointed out.

Schmitt,<sup>60</sup> Olshausen,<sup>59</sup> Schroeder<sup>71</sup> and Bumm<sup>61</sup> (also Spiegelberg,<sup>72</sup> Barnes,<sup>73</sup> Cazeaux,<sup>74</sup> Gerdy,<sup>75</sup> and others accepted the view in part) have contended that the uterus is the initial factor in rotation of the head because the uterus rotates the trunk anteriorly, the rotation being completed by the gutter-like structure of the pelvic floor. More recently Warnekros<sup>76</sup> after a roentgenographic study of the fetus in labor, reports that the rotation of the body frequently preceded that of the head, but believes the pelvic floor plays the predominant part. That the trunk may exert a rotating effect on the head is shown by the phenomenon of external restitution and by the fact that in a breech delivery, the anterior or posterior rotation of the after-coming head is influenced chiefly by the position of the body (Cragin). The most obvious objection to this view is that it does not explain the rotation of the shoulders that occurs after delivery of the head. In regard to the pelvic floor, we agree with Paramore<sup>77</sup> in that the chief action of the pelvic floor is to project the advancing fetal pole forward in a sagittal plane towards the pelvic arch. This is not rotation. We agree with Edgar<sup>78</sup> in that the advancing fetal pole will tend to move toward the area of least resistance, namely, the vulval slit. On the basis of these views we can conceive and grant that the pelvic floor may rotate the flexed head from a right or left occipitoanterior position (O.L.A. or O.D.A.) or even a transverse position, to an occipitoanterior (O.L.A.) in the second stage of labor. If this is accepted, there is no difficulty in Olshausen's explanation. But we cannot understand how the pelvic floor, the incline planes, ischial spines, Sellheim's theory,<sup>79</sup> etc., per se, may operate in causing anterior rotation of the occiput in posterior positions with full flexion. We believe, therefore, that the rotation of the trunk by the uterus plays an important rôle in rotating anteriorly the occiput in posterior positions and in preventing posterior rotation of the occiput (O.P.)

In this connection, however, the classical experiments of DuBois<sup>80</sup> and Edgar<sup>78</sup> cannot be disregarded. In their experiments, performed on a dead fetus and mother, the fetus (head flexed) was placed in a posterior position and either pushed or pulled through the pelvis. Anterior rotation occurred. This shows unquestionably that the resistance offered by the pelvic walls and floor plays a rôle in the causation of internal anterior rotation. But obviously the force had to be applied to the fetus in a "well directed manner" with the head flexed,<sup>85, 74</sup> since it would cer-

tainly be impossible to express or extract the fetus if the "directing force" were not properly applied to the head. This directing force in life comes from a harmoniously contracting uterus.

We realize that Sellheim's view is more generally accepted. Sellheim's view teaches that a cylindrical body, which can be bent to different degrees in different directions, when forced through a curved cylindrical canal must rotate so that the portion which bends most easily will become accommodated to the curvature of the canal. Since his data on recently delivered babies showed that the head is more readily extended than flexed, he argues that the markedly flexed head tends to extend and that this tendency will cause the nape of the neck to rotate to the anterior curvature of the birth canal which at the same time causes extension. We cannot accept this explanation for three reasons: first, a dead, unmaecrated fetus is rotated in the natural birth process and DuBois and Edgar obtained rotation with a dead fetus experimentally; second, it implies that the lever action of the spinal column on the fetal head operates to cause flexion but not extension of the head, which may be viewed as inconsistent; and third, it holds that rotation is independent of the kind of or directional application of the force applied by the uterus.

The mechanical principles by which the resistance of the pelvic floor and walls operate to facilitate anterior rotation is best explained by Paramore, we believe. Paramore's explanation involves an appreciation of the mechanical principles of the two-armed lever that is concerned in causing flexion and extension. The only difference is that in flexion and extension the resisting force is being applied perpendicularly to a "horizontal" plane and that in rotation the resisting force is being applied perpendicularly to a "vertical" plane. (Of course the planes are not perfectly horizontal or vertical.) With the head well flexed, the forehead is eccentric in that the distance from the fetal axis to the sinciput in the "vertical" plane is greater than the distance from the fetal axis to the occiput. As the vertex strikes the pelvic floor, it is deflected anteriorly. The resistance offered to anterior deflection will be more effective on the forehead because the lever arm is longer. Hence, the forehead will move backward about the fetal axis in a screwlike rotatory manner. The levatores ani, decreased resistance of vulval slit and the larger anteroposterior diameter of the outlet will assist after the vertex reaches an anterior position (O.L.A. or O.D.A.). Flexion is essential, since it determines the length of the lever arms or the eccentricity of the forehead. Paramore recognized that an adequate driving force from above was essential to bring the forces into play. Young's<sup>53</sup> explanation is quite similar to that of Paramore except that the former holds that the curvature of the birth canal is important, a point that must be considered in view of the difference in the degree of curvature of the birth canal in lower forms and the human being. We should add that this driving force must

be properly directed by a uterine musculature working harmoniously through a coordinating mechanism.

On learning that the oviduct of the chicken rotates the egg and inversion of the egg frequently occurs in laying, that the small intestine imparts a spiral movement to a bolus, that the vagina of the rabbit manifests a tortuous spiral-like activity, that the uterus of the mare and dog usually rotates the fetus to a dorsosacral position for physiologic birth, it occurred to us that one horn may tend to rotate the fetus in one direction, and the other horn in the opposite direction. Unfortunately our x-ray plates gave us no information on this possibility which awaits further study. Obviously if this actually occurs in the bicornuate uterus, it is possible that such a phenomenon may have been retained in part by the primate uterus. If so, it has an important bearing on the cause of internal rotation.

Hence, we have searched the obstetric literature, and one of us (L. R.) has gone over his obstetric records to ascertain whether the human uterus ever manifests the property of "spiral action" which harmonizes with the longitudinal and circular forces to rotate the body and head. Since the rotation of the trunk by the uterus was discussed above, we shall not discuss that subject again, but we should like to point out that this factor must be kept in mind in regard to the interpretation of the points we are about to discuss.

Although internal anterior rotation generally occurs in the second stage of labor when the presenting part is fully within the confines of the pelvis, there are instances in which rotation occurs in the first stage and before the presenting part is under the full influence of pelvic factors. Stephenson<sup>66</sup> has stated that rotation may occur in the os uteri or on the pelvic floor, so that one cannot confine rotation to any limited portion. The fact, pointed out by Gillespie<sup>82</sup> and others<sup>58, 83</sup> that during uterine systole the presenting part rotates on its longitudinal axis and again recedes during uterine diastole frequently indicates that the resistances are not always fixed. (We have noted the same in the dog.) In footling presentation, Schmitt<sup>60</sup> argues that since the foot rotates while still in the pelvis, this rotation must be due to the rotation of the trunk by the uterus, a mechanism that has been suggested by Duncan<sup>84</sup> and Nagel.<sup>85</sup> Further, in *conduplicatio corpora*, the mechanism of the spontaneous delivery of the fetus is described by Douglas<sup>86</sup> as being due to uterine contractions, the fetus rotates about its vertical axis. One of us (L. R.) has observed that in occipitoposterior positions with the head engaged and with partial cervical dilatation, the head may rotate from a posterior position to the transverse and into an anterior position before complete dilatation of the cervix. This indicates that rotation may occur above the pelvic floor. This has also been observed by Zweifel,<sup>63</sup> Stephenson,<sup>66</sup> Cazeaux,<sup>74</sup> and Edgar.<sup>78</sup> Since rotation apparently occurs at the higher levels of the pelvic

cavity, during the first stage, it is unlikely that mechanical factors in the pelvis are concerned primarily.

The following points emphasize the rotation of the trunk by the uterine muscles. In a roomy pelvis, superrotation of the occiput or shoulders not infrequently occurs (DeLee). It is difficult for us to believe that such a turbid movement is due to the mechanical factors in the pelvis. Further, it is well known that if in persistent occipitoposterior positions in the second stage of labor, the head is rotated anteriorly manually or by a Seanzoni maneuver, the head will rotate back to its original position unless the back is rotated anteriorly or the head is held in place by the hand, a blade of the forceps, or with a Wulsella forceps on the scalp (DeLee). This difficulty is apparently due to the failure of the back to rotate anteriorly. Also one of us (L. R.) observed several years ago that in a diagnosis of O.L.P. or O.D.P., the back would occasionally be delivered in the opposite oblique. At that time this was ascribed to an error in diagnosis. In recent years, the diagnosis has been verified by roentgenograms made before delivery with the result that in a few cases the head would be delivered according to the diagnosis, but the back was not so delivered. This has caused us to study the mechanism involved. The mechanism is as follows: The head enters the pelvic inlet in an oblique diameter with occiput posterior. The body is placed with the shoulders (biscapular diameter) in the opposite oblique, or the transverse. In a normal or *typical* occipitoposterior position, internal anterior rotation of the occiput results. A rotation of the shoulders in the same direction as the occiput occurs, which brings the shoulders finally into the same oblique diameter in which the occiput was at the onset of labor. In an *atypical* occipitoposterior position internal anterior rotation of the occiput results. The shoulders are rotated as in the typical case and the occiput is born. Now the shoulders undergo further rotation, or superrotation, in the same direction and the biscapular diameter is born in the same oblique diameter in which it was when the occiput entered, but with the back anterior, i. e., the shoulder that was anterior is delivered posteriorly. Obviously the uterus must be primarily responsible for this rotation of the shoulders.

*Summarizing the Foregoing Discussion.*—The postnatal tone of the uterine musculature is the basic factor concerned in determining the presentation and position. The attitude of the head in the presence of normal cephalopelvic relations is due to the integration of three factors, namely, a harmoniously contracting uterus, the resistance to egress, and the unequally balanced two-armed lever that exists between the vertebral column and head. If the force transmitted through the fetal spinal column is misdirected by improper coordination of the upper uterine segment, or if the lower uterine segment or cervix is more atonic or yielding in one portion than another, the lever action will be modified or abnormal. The uterus, by rotating the fetal back anteriorly, assists anterior rotation of the occiput.

With the occiput right or left anterior, the levatores ani, the decreased resistance of the vulval slit, and the larger anteroposterior diameter of the outlet may rotate the occiput anteriorly. With the occiput in a transverse or a posterior position, and given a well flexed head, and a uterus that is coordinating and contracting adequately, the vertex on striking the pelvic floor is deflected anteriorly in a sagittal plane and a two-arm lever action operates in a "vertical" plane to rotate the forehead posteriorly and the occiput anteriorly about the vertex or occipitoatlantal articulation as an axis.

A mechanism for the typical and atypical delivery of the shoulders in occipitoposterior positions is offered.

A brief description of the comparative anatomy of the pelvis and the comparative physiology of the uterus in labor has been given. The results of a roentgenographic study of the delivery of the fetus in the dog are reported. On the basis of our studies, we conclude that in "lower animals" the uterus is primarily responsible for placing the fetus in a dorsosacral position for physiologic birth.

Certain human obstetric observations are discussed which may be interpreted as indicating that the uterus may rotate the trunk and head. Whether this is due to the existence of a uterine property of "spiral action" cannot be stated on the basis of the evidence at hand.

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55 EAST WASHINGTON STREET.  
303 EAST CHICAGO AVENUE.

## DISCUSSION

DR. C. S. BACON.—Dr. Rudolph claims that rotation is due to uterine action and that the shape of the pelvis has little to do with it. The question I want to ask is how does the uterus act?

DR. D. A. HORNER.—From some of the pictures shown on the screen I have come to the conclusion that the mechanism of the fetal back is entirely different in human beings than it is in the lower animals. The human being has an erect position, while these x-rays are of animals in the horizontal position. In the human being the back follows the curve of the abdomen rather than the curve of the maternal back. It seems as if earlier in pregnancy the back follows the curve of the abdomen in lower animals, as in the human being, but changes during labor. In the human

being 95 per cent of the pregnancies are carried out at some stage or other with the back anterior or in the dorsopubic position.

The Sellheim experiments have shown that the curve of the canal plus the pelvic floor trough are responsible for the rotation of the fetal head and back.

Whether or not uterine action can rotate the baby depends on whether the bag of waters is ruptured. If the bag of waters is intact I doubt if the uterus can act on the baby floating inside the bag of waters and rotate it any way, anteriorly or posteriorly. With the bag of waters ruptured, the uterus contracts down on the fetus, often grips it tightly and may actually prevent its anterior rotation. The descent which is encouraged by rupture is responsible for whatever anterior rotation occurs.

Dr. Rudolph made one statement to which I must take exception, namely that, when the head is delivered, the shoulders may be above the inlet. The curve of the sacrum is 12 cm. and from the tip of the sacrum to the tip of the stretched perineum 12 cm. more making 24 cm. in all. As far as I know, no neck is that long and consequently no head could be delivered with the shoulders above the inlet.

DR. EDWARD L. CORNELL.—I rather hesitate to accept the statement that the uterus itself is capable of rotating the fetus, providing the bag of waters is intact. In exceptional cases it has been my observation that without any uterine contraction the fetus has rotated when the head is within the pelvis, but this has not been more than ten to fifteen degrees. If that is possible without a contraction, I would hesitate to say that the uterus itself can rotate a baby.

That the fetus can change its position of its own momentum without uterine contraction, I think is accepted. Spontaneous version is frequently seen in pregnancy and almost invariably the patient will tell you that at a certain time there was a great commotion in the abdomen. It has not been my fortune to see spontaneous version but I have always felt the activity of the fetus had something to do with rotation or with version.

DR. E. W. FISCHMANN.—In woman, because of the upright position and the absence of a tail, the tail muscles of the lower animals have been changed to the muscles of the pelvic floor which give support to the pelvic organs. Dr. Rudolph stated that the uterine contractions cause rotation of the fetus, but is not a pivotal point necessary for this rotation, probably the pelvic floor? I agree with Dr. Horner that the pelvic floor plays a most important rôle in the mechanism of labor, because we often find that in a multipara with a markedly relaxed pelvic floor there is no mechanism of labor at all, because the muscles of the pelvic floor are markedly separated and hence do not serve as a pivotal point for internal rotation, etc.

Dr. Rudolph speaks of the longitudinal muscle fibers; there are none in the human uterus for the fibers are arranged more or less haphazardly and interlace and cross each other.

DR. RUDOLPH (closing).—The work of Sellheim was based on purely mechanical principles of a double cylinder passing through a rigid curved canal. Dubois and Edgar's experiments seemed to corroborate the mechanical principles without attempting to evaluate the importance of the manner in which the directing force was directed. In labor we are dealing with a physiologic process in which both the fetus and the genital tract consist of vital structures, so that the experiments of Dubois and Edgar and the experiments of Sellheim, Moir and Young cannot be accepted as conclusive.

Dr. Bacon asks, what is the mechanism? According to Howell, we do not know the mechanism of peristalsis, pendulum movement and segmentation of the gastrointestinal tract. We accept it as a physiologic process irrespective of the mechanism

involved. The mechanism of the uterus is based upon physiology, even if we do not know the underlying mechanism.

We believe that the uterus by its coordination or incoordination will direct the longitudinal force in such a manner as to bring about flexion or deflexion. How does it occur? We do not know, neither do we know what brings about the onset of labor, but we accept the biologic knowledge that the onset of labor occurs in different species after a certain period of pregnancy.

Warnekros has demonstrated that the position of the fetal head is usually in some form of deflexion. Therefore, gravity or intranterine pressure does not play a marked rôle in the mechanism of flexion of the fetal head during pregnancy. With the onset of labor the fetal head becomes flexed, which we must accept as being due to the uterine contractions in the normal mechanism of labor. This leads us to the premise that the distention of the uterus does not occur on account of the growing fetus, but is a physiologic coordination of the growth of the uterus to the demands of the growing fetus.

If evolution has any value in medical science, why should it not be related to obstetrics? If the uterus in the lower animals has rotatory power, why is it not logical to assume that perhaps the human uterus has retained that property? We have demonstrated that the pelvis was developed on account of physiologic demands, and that in the different species the mechanism of the delivery of the fetus was such that some vital structure had to determine the manner in which the fetus must be delivered. We believe that by the Law of Natural Selection the uterus has determined the mechanism by which the fetus is delivered in the different species, as well as in man.

In normal labor the head enters the pelvis in the oblique diameter, in the main, but in contracted pelvis it attempts to enter in the transverse diameter to allow the smallest diameter of the head to pass through the anteroposterior diameter by either the biparietal or the bitemporal diameter. In a generally contracted pelvis the head attempts to pass into the pelvic cavity in the oblique diameter because it is still the largest diameter. Nature economizes the space in whatever manner it finds logical and that the directing active force is the uterus.

Dr. Fischmann asks about the pivotal point for the mechanism of rotation. The pivotal point is any part of the point of direction which comes in contact with the uterine wall directly or indirectly through the liquor amnii in order to form two opposing forces, and the angle formed will depend on whether the head remains stationary or is rotated anteriorly or posteriorly.

We believe that many cases are called disproportion on account of the deflexion of the head, which is due to the syndrome we have presented and is based upon uterine dysfunction. Wilson in a recent number of the *Journal of Obstetrics and Gynecology of the British Empire* writes, "Disproportion is usually the reason given when cesarean section is performed in an apparently normal pelvis and for some reason the head does not fit the pelvis well. It may be correctly ascribed to a certain amount of deflexion of the head due to or associated with imperfect functioning of the uterus." Therefore, our problem as obstetricians is to determine the manner to correct the uterine dystocia and not by means of increasing the number of cesarean section which increases morbidity and mortality.

We believe that through comparative obstetrics, we can study the physiology of parturition and as in the other branches of medicine apply that knowledge to the human uterus. We have considered too much the mechanical factor and should know more of the physiology of labor.

## THE RESPIRATORY FUNCTION OF THE DETACHED PLACENTA

G. M. BRANDAU, B.A., M.D., HOUSTON, TEXAS

THE interchange of gases through the walls of the chorionic villi, between the fetal and the maternal bloods occupies a prominent place in placental physiology. Except for this, death of the fetus would quickly supervene. In this paper evidence is presented which, I believe, will show that after separation of the placenta from the uterine wall oxygen may continue to be received and utilized by the fetal blood.

A review of the histologic structure of the chorionic villi will serve to clarify the subject matter at hand, hence without attempting a detailed description of the form and development of the placenta a brief outline of the facts pertinent to the discussion is presented. The chorion consists of two layers; an outer trophoblastic layer, and an inner mesodermal layer. The trophoblast in turn is made up of two layers; (1) an outer layer of nucleated protoplasm without cell boundaries called the syncytiotrophoblast or syncytium, and (2) an inner layer of cuboidal cells called the cytotrophoblast or layer of Langhans. The early chorionic villi consist at first of solid outgrowths of the trophoblast reaching out from the chorion over all its surface. Later these finger-like processes are invaded by mesoblastic tissue which then forms the core of the villi. Accompanying the ingrowth of mesoblastic substance is a system of blood vessels which in each villus consists, when developed, of an afferent arteriole, a mesh of capillaries, and an efferent venule. The arteriole carries mixed but essentially venous blood from a branch of the umbilical artery to the capillary tuft where it is purified to return through the vein as arterial blood. Demonstration of the facts that the umbilical arteries contain venous blood and that the umbilical vein contains arterial blood, together with the consideration that compression of the cord or abruptio placentae causes fetal asphyxiation, prove that oxygen is supplied to the fetal blood in the placenta,<sup>1</sup> and that adherence of the placenta to the placental site is necessary for the maintenance of the oxygen supply of the fetus in utero. After the second month the chorionic villi in contact with the decidua capsularis gradually undergo atrophy, while those in contact with the decidua basalis grow and develop, forming numerous branches and ramifications as well as increasing in size. Into these branches the system of blood vessels is likewise projected. The blood in the capillaries then is separated from the maternal blood in the intervillous spaces by the endothelium of the capillaries, the reticular mucoid stroma of mesoblastic tissue, the cytotrophoblast and the syncytium. At term the cytotropho-

blast has disappeared and the syneytium has become thinned out into a narrow band. Through these layers intervening between the fetal and maternal bloods the interchange of gases takes place by osmosis or cell activity, or both; although the preponderance of evidence indicates that it is mainly or entirely by osmosis.<sup>2</sup> Water and nutritive materials also pass through, and in the transference of protein substances in the form of amino acids, the vital action of the cells seems to play a more important rôle, but for the present thesis the gaseous exchange is our chief concern.

Soon after the birth of the baby the circulation in the cord ceases, the lungs at this time assuming the function of oxygenation of the blood. The pulsation of the umbilical arteries in the funiculus can no longer be felt and the activity of the placenta as a fetal organ is at an end.

It has been observed in a few instances when a baby was born with the placenta and unclamped cord expelled intact that the baby lived without respiration or asphyxiation for some time while the circulation through the cord and placenta continued. Schumaecher<sup>3</sup> recently reported such a case in which a fetus miscarried in the fifth month and never breathed, and no artificial respiration was applied, yet the fetal heart beats continued for fifty minutes. In reporting this case the author advanced the opinion that the oxygen present in the blood in the fetus, cord, and placenta at the time of expulsion was sufficient to supply the needs of the fetus for the length of time specified, and that when this was chemically exhausted the heart stopped beating. However, he also suggested the possibility of "a sort of branchial respiration" by an intake of air through the placental villi, wounds (wound surface), and capillaries, maintaining the oxygen supply and the carbon dioxide waste. An incident of similar nature is outlined in the following case report.

#### CASE REPORT

The patient was an unmarried teacher, colored, twenty years of age. She had not reported for any prenatal care or supervision and at the time of her confinement was attended by an amateur midwife. Labor came on prematurely at about six months. After the birth of the baby she bled rather freely, the attendants therefore decided to apply for medical aid in the further handling of the case. On arrival I inquired about the baby and was told it had been born thirty minutes before, so my attention was turned at once to the mother who was bleeding freely enough to demand immediate treatment. It was approximately fifteen to twenty minutes or more before the condition of the baby could be investigated, or at a most conservative estimate forty-five minutes after birth. The infant was at the foot of the bed loosely covered with bedclothes; on lifting these the ovum was found to be intact, the bag of waters unruptured. The sac was broken and the baby lifted out. The heart was beating strongly, the color was normal and but little effort was required to induce respiration. The cord was clamped and severed. Breathing continued spontaneously but was rather shallow and crying was weak. The infant was wrapped in cotton, kept warm by external heat, and supportive and stimulative measures were instituted. He lived twenty-four hours, dying then because of respiratory failure and prematurity. Autopsy was not obtained.

## COMMENT

A case with such sequence of events would never occur in a hospital where trained assistants are present to assume charge of a baby at birth, nor would it be likely to come about in a home delivery if the accoucheur were present during the second and third stages of labor; hence the case history itself being unusual, certain conclusions are suggested by a consideration of the clinical data which would not be apparent in the ordinary case as usually conducted.

In the first place, although the infant did not breathe for three-quarters of an hour, there was no evidence of asphyxiation nor of decreased or embarrassed heart action, so that it is a necessary deduction that during this time the baby was receiving his required amount of oxygen. The amount of blood in a newborn baby of average weight is approximately one-eleventh of the body weight, or about 280 gm. The amount of blood in the cord and placenta varies and no record of the accurate determination of its volume or weight is available, however the ratio between the amount in the fetus and the amount in the cord and placenta is somewhat more than 2:1. After compression of the cord the fetus may survive for five to ten minutes, rarely fifteen, and very rarely twenty minutes,<sup>4</sup> so that were the amount of fetal blood in the cord and placenta equal to the amount in the fetal body we should not expect the fetus to survive as long as three-quarters of an hour without reoxygenation of the blood. But with the usual length of time of survival, the cord and placenta would have to contain from four to five times as much blood as the fetus, whereas in reality they contain less than one-half as much. In cases of abruptio placentae with complete detachment, the length of time of survival of the fetus has not been determined, yet with the onset of symptoms violent fetal movements are felt by the mother and these are presumably the agonal struggles of the asphyxiated infant.

In the case reported the fetal body metabolism was active at at least the basal rate, and oxygen must have been consumed yet the total volume of blood in the fetus, the cord and placenta would be insufficient to supply the requisite amount of the gas for the length of time specified without reoxygenation. Therefore, we must conclude that the fetal circulation was receiving oxygen from some outside source. As the fetal organism was consuming rather than generating oxygen the source of supply must be looked for in the cord or in the placenta. The cord was enclosed in the amniotic sac and surrounded by amniotic fluid, its blood vessel walls comparatively dense and these covered by a greater or less thickness of Wharton's jelly and overlaid with a layer of ectoderm. Furthermore, even were it possible for oxygen to penetrate these structures only a small portion of the blood corpuscular surface would be exposed to it, hence oxygenation would be incomplete. This then leaves the placenta as the only source of the oxygen supply. Here we have the blood in the capillary meshes of the villi separated from the air by a single layer of endothelium, a small amount of mesoblastic stroma, and a thinned out syncytium; structures whose permeability to oxygen and carbon dioxide as exchanged between maternal and fetal bloods has long been recognized. There is this difference however, that oxygen exists in the maternal blood in a combined form (oxyhemoglobin), and in the air as a free gas mixed with other gases. But the oxygen in oxyhemoglobin is so easily dissociable that the oxygen tension is regulated by the oxygen pressure in the surrounding atmosphere just as though it were merely in solution,<sup>2</sup> and transference of the gas is by dialysis through the intervening structures. The condition in the case discussed here is analogous to that obtaining in the respiring lung where the blood in the capillaries is separated from the air by the thin walls of the capillaries themselves, a small amount of delicate connective tissue containing the capillary network, and the simple squamous epithelium lining the alveoli and alveolar air sacs. So a careful evaluation of the data presented leads to

the conclusion that in this case a gaseous exchange took place between the atmospheric air on the one hand, and the blood circulating through the capillaries of the chorionic villi on the other.

The cause of the premature labor was not ascertained but the gross appearance of the placenta indicated no abnormality in its structure nor any disease of its tissues, and though generalizations are hazardous it seems justifiable to suppose that any normal placenta under similar conditions might function in the same manner.

Schumacher<sup>3</sup> in his paper points out the importance of the placental blood in improving the prognosis in asphyxia or of threatened asphyxia of the newborn, and shows the value of his observations in supplying a hitherto unrecognized reason for not clamping the cord in such cases while the circulation continues through it, and also in pointing out the importance of starting artificial respiration before compressing the umbilical vessels.

#### SUMMARY

1. The passage of oxygen through the walls of the chorionic villi from the maternal to the fetal blood and of carbon dioxide from the fetal to the maternal blood have long been accepted by physiologists as proved phenomena.

2. That the same interchange of gases may occur between the fetal blood and the atmospheric air after detachment of the placenta from the uterine wall is not so widely recognized.

3. A case is reported in which the assumption of such a gaseous interchange is requisite to a rational explanation of the sequence of events in the case history.

4. This function of the detached placenta may have a practical application in the treatment and prevention of some cases of asphyxia neonatorum.

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Boggan, R. H., and Wrigley, A. J.: Rupture of Ovarian Blood-Cysts Simulating Acute Appendicitis. *Lancet* 221: 1068, 1931.

The authors report 13 cases of this condition, the right ovary was affected in ten. They imply that the ovarian hemorrhage is an exaggeration of the normal physiologic mechanism of the rupture of the Graafian follicle. The essential diagnostic differences favoring ruptured ovarian blood-cyst are: the sudden onset of severe lower abdominal pain in relation to slight trauma; the good general condition of patient in spite of its duration; and marked lower abdominal tenderness without marked muscular rigidity.

They advise exploratory laparotomy if the diagnosis is uncertain (usually) and recommend at operation enucleation of the hemorrhagic area.

H. CLOSE HESSELTINE.

# THE BERCOVITZ TEST FOR PREGNANCY

## A REPORT OF 260 CASES

ARTHUR G. KING, M.D., NEW ORLEANS, LA.

*(From the Department of Obstetrics, Tulane University Medical School,  
and Charity Hospital)*

THIS investigation of the pupillary reaction described by Bereovitz in 1930<sup>1</sup> as a diagnostic aid in pregnancy, was undertaken on the obstetric service of Dr. E. L. King, in an effort to determine the reliability and value of the test.

The technic as presented by Bereovitz consisted of instilling into one eye of the patient a few drops of her own blood. At first serum was used, but this was later modified to citrated whole blood. Pregnancy was indicated by either a dilatation, a contraction, or an alternation of the two, in contrast with the other eye in which there was no change. His studies revealed that the patient's blood was capable of producing the same reaction in the eyes of nonpregnant individuals and in rabbits and cats. Precautions had to be taken before the test that the pupils were equal in size, and that the two eyes were evenly illuminated by a soft yellow light. The quality of the light and its intensity were particularly stressed. Of 72 nonpregnant women, not one gave a definite positive test. In 72 observations on 68 pregnant women, 80 per cent showed a definite pupillary change, 4 per cent a doubtful change, with the remainder giving no reaction.

Gordon and Emmer<sup>2</sup> partially confirmed the test, using citrated blood. Their results showed a positive reaction in 64 per cent of 90 pregnant women. They made the statement, without data, that no nonpregnant woman gave a positive reaction. White and Severance<sup>3</sup> performed the test on 58 pregnant women, of whom but 19 gave a positive reaction, and on 15 nonpregnant women, of whom 3 did respond positively.

In the series, herewith reported, citrated blood was used at first, but soon the technic was simplified by taking from the finger several drops of blood in an ordinary medicine dropper and transferring it directly to the conjunctival sac. The light used was either a low power electric bulb in a darkened room, or else daylight through heavy yellow shades. The pupils were examined first for equality and reactivity, and the patient was forced to fixate on a distant point to obviate accommodation changes.

The objections to the test are many. Fig. 1 illustrates the relative size of the pupils in the ordinary positive case. The end-point is very hard to read, and the reaction, furthermore, is relatively transitory. The matter of illumination is of such importance that the experimental error may be very large. There does not seem to be available any means of making precise measurements or a permanent record, and hence the variable factor of the personal equation must be depended upon. The test is not adapted to individuals with dark eyes, particularly negroes. Herewith are presented, however, the results of this investigation with the technic in its present status.

All three types of reaction pointed out by Bereovitz were observed. These appeared in from a few to thirty seconds and persisted from one to



about three minutes. The relative frequency in 73 positive cases was as follows:

Dilatation	27
Contraction	28
Alternation	18

In the series there were 107 cases of definitely proved pregnancy, of which 93 came from the prenatal clinic and 14 from the gynecologic wards, representing either threatened or recent incomplete abortions.

The patients were studied in respect to the following details: age, parity, length of gestation, and nervous constitution. There were several cases each of thyrotoxicosis, syphilis (both treated and untreated), dia-

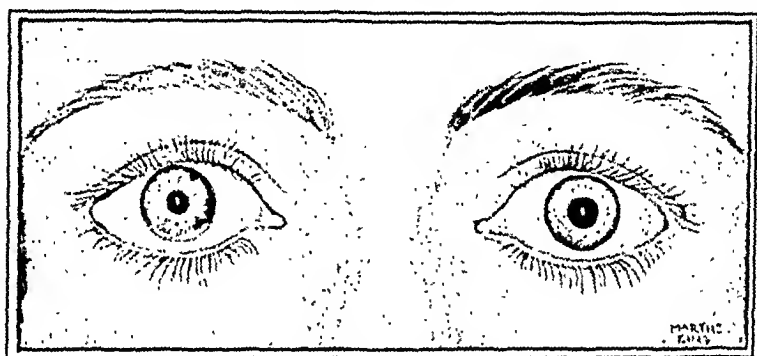


FIG. 1.—Showing the difference in the size of the pupils in the ordinary positive reaction of the Bercovitz test in pregnancy.

betes, fevers of various origins, and toxemias of pregnancy. Neither the correctness of the result nor the type of reaction was influenced by any of these factors.

Numerous positive tests were obtained as early as seven or eight weeks after the last menstrual period, often before pregnancy could be diagnosed clinically with any certainty; these cases were all confirmed later, however. In two cases negative results were obtained at eight weeks, with positive reactions appearing at the tenth and twelfth weeks respectively.

On the other hand an observation was made that is disturbing statistically, namely, that in the same woman the test might be positive on one occasion, negative on another, and positive again later, but with a different type of reaction. The conditions under which the testing was done were almost identical, but the factor responsible for this variability and for the false negative reactions is as mysterious as the cause of the phenomenon.

The results obtained with these known pregnant women are given in Table I. It appears that not more than two out of three pregnant women will give a clear-cut positive reaction with this test.

#### EPINEPHRINE

Bercovitz suggested that the reaction might be due to an epinephrine-like substance, and found that epinephrine (1-1000) when dropped into

the eyes of the same series of pregnant women gave 76 per cent positive, 2 per cent doubtful, and 20 per cent negative results. He noted that 2 of 98 nonpregnant women gave a positive reaction.

In this investigation, epinephrine gave no positive reaction in 40 nonpregnant women. Table II summarizes the results in 45 pregnant women. It is seen that the results with epinephrine were not nearly so good as with

TABLE I. REACTIONS WITH KNOWN PREGNANT WOMEN

	OBST.		GYNEC.	TOTAL 107 CASES		BERCOVITZ 72 CASES	GORDON & EMMETT 90 CASES
Positive	61	66%	12	73	68%	80%	64%
Doubtful	11	12%	1	12	10%	4%	13%
Negative	21	22%	1	22	21%	16%	21%

TABLE II. COMPARISON OF RESULTS WITH BLOOD AND EPINEPHRINE IN PREGNANT WOMEN

BLOOD		EPINEPHRINE		
		POSITIVE	DOUBTFUL	NEGATIVE
Positive	(27)	15	0	12
Doubtful	( 9)	3	3	3
Negative	( 9)	4	0	5

blood, although the series is too small to discuss percentages. But in four of these pregnant patients in whom the blood was negative, and in three in whom it was doubtful, the epinephrine reaction was distinctly positive. On the other hand it was interesting to note that in four of the confirmatory positive tests, the type of reaction was different. In general, contraction was noted as often as dilatation.

The concept of the cause of the reaction being an epinephrine-like substance does not appear to be tenable. The typical epinephrine reaction is dilatation. Consultation with several physiologists revealed the information that epinephrine ordinarily affects the pupil only in the presence of a lesion of the cervical sympathetic system and in some cases of glaucoma.

#### PUERPERIUM

Bereovitz stated that the reaction disappears in from three to seventy-two hours after labor. Unfortunately, in this investigation it was not possible to follow in the wards all the women seen in the clinic. The results of 45 tests performed during the puerperium are given in Table III.

TABLE III. RESULTS OF TESTS DURING THE PUERPERIUM

	6-24 HOURS	24-48 HOURS	THIRD THROUGH NINTH DAY
Positive	5	1	1
Doubtful	2	0	4
Negative	12	4	21

Similar to the observation made in the prenatal clinic, one woman with a threatened abortion gave no reaction before delivery, a positive six hours after delivery, and a negative reaction two days later.

Two cases must be taken up separately as they have not been included in any of the tables because of the difficulty in classification. One woman had delivered thirteen months before, was lactating, and had not menstruated in the interim. She was definitely not pregnant, but gave a positive reaction. The other woman had given a positive reaction on the eighth day postpartum; three months later she gave a positive reaction, although of a different type. She had menstruated once in the meantime, and was definitely not pregnant. These two constitute false positives and weaken the value of the test in situations where it is most needed.

#### NONPREGNANT INDIVIDUALS

The nonpregnant individuals were divided into three groups: gynecologic cases, males, and normally menstruating young females.

Of 26 gynecologic patients, 5 with simple amenorrhea, 2 at the menopause, 2 with cancer of the cervix, and 17 with uterine bleeding where no decidua tissue could be demonstrated, all gave definitely negative reactions.

TABLE IV. RESULTS OF TESTS ON NONPREGNANT INDIVIDUALS

	GYNEC.	MALES	FEMALES	TOTAL	
Positive	0	0	2	2	2%
Doubtful	0	3	8	11	10%
Negative	26	18	49	93	88%

On the other hand, of 20 men tested, only 18 were distinctly negative. One man had a questionable contraction, and another, on two different occasions, showed considerable activity in the tested pupil in contrast to the control pupil, although the reaction was not definitely positive. Each of these two young men was of the nervous type, without, however, any signs of endocrine disorder.

Bercovitz, and Gordon and Emmer, failed to obtain a positive reaction in their normally menstruating groups. It was felt for a time, particularly after the excellent results with the gynecologic patients, that a positive reaction definitely indicated pregnancy. The two special cases referred to above, and the reactions in the young men cast grave doubts on this hope. This was confirmed by a series of young women who were menstruating regularly, and who, by reason of intelligence, position, and training, could be reasonably assumed to be not pregnant, although they were not examined. They were studied in relation to nervous constitution, normality of catamenia, and the time of the test in the menstrual cycle. None of these factors seemed to have affected the results. Some girls giving a doubtful reaction when menstruating, when reexamined a week or two later were definitely negative; on the other hand, some girls giving a doubtful reac-

tion in the middle of the cycle were negative when they menstruated. Of this series, 2 showed positive reactions and 8 gave doubtful tests.

The results are summarized in Table IV to which must be added the two false positive reactions at three months and thirteen months respectively after delivery.

#### SUMMARY

1. The value of the Bercovitz pupillary reaction in pregnancy, although it is exceedingly simple, is greatly impaired by the difficulty in reading the result and by the fact that much depends on the personal equation of the observer.

2. In 107 cases of proved pregnancy a positive result was obtained in 68 per cent, a doubtful response in 10 per cent, and a negative result in 21 per cent.

3. Epinephrine, 1-1000, will give similar reactions, to some extent. In 7 cases out of 45, epinephrine gave a correct positive result when the blood test was either negative or doubtful.

4. The reaction is not constant in the same woman at different examinations.

5. The reaction disappears early in the puerperium in most but not all cases.

6. In 108 tests on nonpregnant individuals there were 4 false positive responses and 11 doubtful reactions.

#### CONCLUSIONS

From the data presented here it must be concluded that the test, using the technic of Bercovitz, is not reliable enough to be of value in doubtful cases of pregnancy. The reaction is empirical in nature; it lacks precision, and is liable to error in interpretation because of technical difficulties and the personal factor.

On the other hand the phenomenon is interesting and merits investigation in the hope that the explanation of it will throw more light on the physiology of pregnancy.

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## VARICOSE VEINS OF PREGNANCY\*

NORMAN J. KILBOURNE, M.D., LOS ANGELES, CALIF.

IN THE city welfare clinics of Los Angeles for prenatal patients, directed by Drs. Boehm and Pott, it was found that of 110 consecutive patients, 23 had outright varicose veins, and 27 had telangiectases of the legs. Thus the pregnancy patients had varicose veins in one case out of every five, and if we add telangiectases, there were incipient venous dilations in almost half the prenatal cases. This indicates that varicose veins in the prenatal patient are a problem of importance.

### ETIOLOGY

There is a notion amongst obstetricians, dating from Pierre Dionis, 1707, that these veins of pregnancy are due to pressure by the pregnant uterus on the external iliac or common iliac veins in the pelvis, obstructing the venous flow.<sup>1</sup> This notion is called in doubt by four considerations. First, the varicose veins have been reported as beginning early in pregnancy before the uterus had enlarged and risen sufficiently to reach the external iliac veins.<sup>2</sup> Secondly, it has been reported that in cases where the fetus died in utero but was not expelled, the veins regressed at once, before the uterine mass could have involuted sufficiently to relieve pressure on the iliac veins.<sup>3</sup> These two statements need verification by further observations by obstetricians. Thirdly, when the varicose superficial saphenous vein was entirely obstructed by a ligature in 381 patients, the veins were not made worse but were improved.<sup>4</sup> If the whole trouble were caused by obstruction due to pressure by the uterus on the external iliac vein this could not occur. And fourthly, the majority of pregnant patients in the early stages of vein disturbance show small varices with a distribution scattered all over the legs, and not confined to the main tributaries of the great saphenous. Recently I saw in consultation a primipara, pregnant for four months, with enormous varicose veins high on the side of the body over the right kidney region. They had been present before pregnancy as congenital anomalies but had become much worse since she had become pregnant. It would be difficult to explain their increase at this location because of pressure by the uterus on the iliac veins. All these considerations point to some other cause.

It is likely that this cause will be discovered through the study of a phenomenon which no one apparently has yet noticed: namely, that in pregnancy, venous dilatation is only part of a general dilatation of all the smooth muscle tubes of the woman's body. There are four such smooth muscle tubes: the müllerian duct tube, the wolffian duct tube, the gastro-

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\*Read before the Los Angeles Obstetrical Society, February 9, 1932.

intestinal tube, and the blood vessel tube. In pregnancy the smooth muscle in all four of these tubes loses its tonicity.

In the wolffian duct tube, the early dilatation of the ureters was described by Cruvelhier<sup>5</sup> as early as 1843, and has been many times confirmed. I quote from Olshausen,<sup>6</sup> Prutz,<sup>7</sup> Lohlein,<sup>8</sup> Carson,<sup>9</sup> Hofbauer,<sup>10</sup> Seng,<sup>11</sup> Mandruzzatto<sup>12</sup> Gellhorn<sup>13</sup> and Draper<sup>14</sup> who report in almost identical words, as follows:

"During pregnancy the ureters always dilate. The dilatation is demonstrated about the eighth week and is very marked. The ureteral dilatation cannot be ascribed to pressure from the enlarged uterus because it has been observed in the first weeks of pregnancy. In a minority of the women the ureters, having once been dilated, return to normal, but in a relaxed state, after the ninth to twenty-fifth day postpartum. In the great majority the dilatation persists after the twenty-fifth postpartum day, and continues in a lesser degree over a prolonged period of time. Our studies have impressed us with the tissue factor of each individual woman."

Not only is there dilatation, but also a hypertrophy. Hofbauer has shown the stimulus of pregnancy leads not only to hypertrophy of the uterus, but also hypertrophy of the muscle in the trigone of the bladder, in the lower end of the ureters and in the vagina. There is this same hypertrophy of the muscle in the walls of the veins.

In the gastrointestinal tube there is, in pregnancy, a similar loss of tonus in the smooth muscle. Gellhorn<sup>15</sup> has found that the intestines like the uterus have a lowered tonus in pregnancy and Alvarez<sup>16</sup> after work on animals finds there never was much question about the existence of a gradient from duodenum to ileum or about its reversal, or flattening in pregnant animals. Even the muscle of the gall bladder derived embryologically from the intestinal tube loses tonicity and power to contract and empty.<sup>17</sup>

In the blood vessel tube, the arteries as far as blood pressure indicates, undergo this influence only slightly for reasons of obvious biologic necessity, but the tendency to dilatation of the veins is before you. Thus far in recognizing venous dilatation in pregnancy as a part of a generalized dilatation of smooth muscle we are on firm ground of fact.

When, however, we turn to search for the explanation of this fact, the path is not clear. The fact that this loss of tonicity is not limited to the veins but is generalized, points to some physiologic influence. Meisen<sup>18</sup> believes this is a toxemia of pregnancy. Possibly Henderson's recent work<sup>19</sup> may show some relation of the loss of smooth muscle tonus to the respiratory activity in pregnancy. The French clinicians, Sieard,<sup>3</sup> Gaugier,<sup>20</sup> Delater,<sup>21</sup> and Forestier<sup>22</sup> have been convinced that it is due to a change in endocrine equilibrium. Forestier and Gaugier believe that it is due to insufficiency of posterior pituitary secretion. Unfortunately the French school has shown inadequate proof of their position.

In favor of such a hypothesis, I can gather only this fragmentary evidence:

The posterior pituitary extract is probably more than a mere accidental content of the dead protoplasm of the pituitary, for Krogh<sup>23</sup> has shown that in the horse it is constantly secreted by the living pituitary into the blood stream through the internal jugular vein. This secretion when injected artificially into the body, causes contractions in the muscle of such müllerian duct derivatives as the uterus and powerful contractions of such wolffian duct derivatives as the ureter<sup>24</sup> and bladder.<sup>25</sup> Although its action on the intestinal tract under abnormal conditions may be variable<sup>26</sup> every practical clinician knows that in nearly every normal individual the bowel movements which follow its use point to intestinal contractions. There has been some evidence to show that it raises the tonus in the arteries and veins.<sup>27</sup>

We cannot conclude that just because it is probably secreted normally into the circulation, and because given artificially it causes contractions of smooth muscle, that therefore it is the normal physiologic stimulus to the tonus of these muscles. A beginning in this direction however has perhaps been made by Krogh working on the lower animals, who found by experiments on the capillaries and melanophores of frogs that in the case of the capillaries there is a substance circulating in the blood which does maintain the normal tonus of the smooth muscles in the walls of the capillaries, and without which the tonus is lost, and that this circulating substance is identical with posterior pituitary secretion!

When we turn for evidence to show that the action of the posterior pituitary secretion is diminished in pregnancy a number of experiments are significant. Knaus<sup>28</sup> found in experiments on rabbits that in them it was possible after the eighteenth day of pregnancy to induce an abortion with very small doses of posterior pituitary extract and ascribes the inertness of the uterine contractions in the first half of pregnancy to the hormonal action of the ovary neutralizing or paralyzing the hormone of the posterior pituitary. Brown is so confident of this lack of pituitary secretion during pregnancy that he administers it in cases of toxemias of pregnancy. Krogh<sup>23</sup> found that although experiments with human blood were unsatisfactory, that its concentration seemed lower in the later stages of pregnancy than during labor. Finally Siegert<sup>29</sup> in experiments on the excised uterus of rats and guinea pigs has shown that the follicular hormone which everyone now knows is present in the blood during pregnancy in enormous amounts, checks or entirely nullifies the posterior pituitary secretion.

I hope that I shall not be quoted as accepting this belief of the French school that disturbance in the endocrine balance causes venous dilatation. I am merely mentioning it as a hypothesis deserving further study.

A new instrument for measuring venous pressure is being perfected by Eyster and this may enable us to determine directly the effect of posterior pituitary secretion and the hormones of pregnancy on the veins.

It is hoped that not only the pharmacologists but the obstetricians and urologists may cooperate to help to solve this problem.

#### ROUND GARTERS IN PREGNANCY

For many years obstetricians have warned the pregnant patient not to wear round garters lest they cause varicose veins.

The question as to whether the obstetric patient should be warned not to wear round garters depends upon the direction of the blood flow in the superficial veins of her legs. If there is an important circulation in these veins upward, then it is right to forbid the wearing of round garters lest they obstruct the upward flow and cause the veins to bulge below the garters. On the other hand if the blood flow in the superficial veins is downward in a hydrostatic dead weight away from the heart toward the feet, then the round garters are a very good thing for the patient, for they obstruct no upward flow and hold back the heavy downward pressure of blood which would tend to bulge them out in dilatations. Experiments by Barber<sup>30</sup> brought contradictory reports but rather indicated that there is an upward flow in the superficial veins. Fluoroscopic examination of the veins after the injection of lipiodol as a radio-opaque medium by Magnus, Sicard and McPheeters have shown the flow emphatically downward toward the feet. Schmier<sup>31</sup> has thought this might be an error due to the great weight of the lipiodol which might carry it downward against the direction of the blood flow. He repeated this work with lipiodol especially prepared of a concentration to give a specific gravity equal to that of normal blood. His results with such a preparation showed that in some patients with varicose veins *vis a tergo* pressure from the capillaries slowly forced the blood upward against the dead weight of hydrostatic pressure. In other patients he found exactly the reverse to be true and the blood flow in their superficial veins was downward, then through communicating veins low in the leg to the deep veins, and thence upward.

I have used uroselectan (Iopax) as a radio-opaque medium. I have experimented mixing it with blood in a glass tube and find it diffuses, mixing with the blood, and does not sink through the blood. Fig. 1 shows a normal vein into which 1 c.c. of uroselectan has been injected just above a valve. The valve has efficiently prevented direct downward flow. There is some downward flow by way of the communicating veins until numerous small valves are reached when the downward flow is halted. There may be some upward flow due possibly to the mere mechanical pressure conveyed from the piston of the syringe but whatever upward flow there may be is at any rate a most feeble affair for although this picture was taken half a minute after injection the shadow of the uroselectan in the vein is still there and has hardly moved upward an inch.

Further x-ray studies indicate that in the normal person in the standing position there is very little upward flow in the superficial veins, and



that there is a definite downward flow below the great valve in the saphenous just below the knee. During exercise the circulation, possibly upward, may be increased but veins are not distended by exercise. If a distended segment of a normal or varicose vein is isolated between two rubber bands and the patient is asked to walk, the full superficial segment is soon emptied. The recumbent position is also unimportant in this problem, patients remove their garters when they go to bed, and the superficial veins always empty anyway.

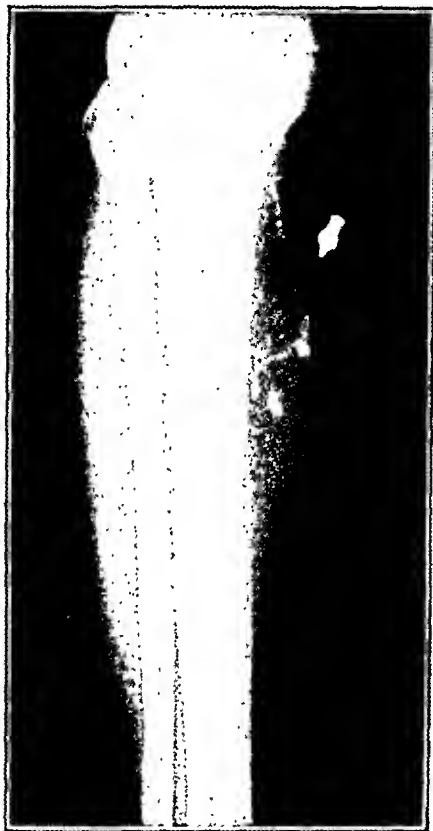


Fig. 1.



Fig. 2.

Fig. 1.—The circulation in the normal vein above the great valve shown twenty-five seconds following the injection of 0.5 c.c. of 33 per cent uroselectan.

Fig. 2.—Downward flow in varicose veins of multipara in the tenth month, twenty seconds after injection of uroselectan. Double positive Trendelenburg.

The next picture (Fig. 2) shows the left leg in which there was a double Trendelenburg, which means that by a clinical test it had been shown that the valves of this leg were incompetent in both the superficial veins and in the veins communicating between the superficial and deep veins. The shadow in the leg even in the instant after injection is moving downward from the point of injection at the finger tip. There is no sign of any upward flow even though there was time for the circulation to pass upward before the finger was applied.

This next picture (Fig. 3) taken one minute and twenty seconds after

injection shows the shadow passing not only downward but through a communicating vein with an incompetent valve into a straight deep vein by which it is now ascending rapidly upward.

Fig. 4 shows the other leg in which there was a single positive Trendelenburg, which means that clinical tests had indicated that the valves in the superficial veins were incompetent but that the valves in the communicating veins were competent. This picture taken immediately after injection shows no upward flow but a rapid downward flow in these super-

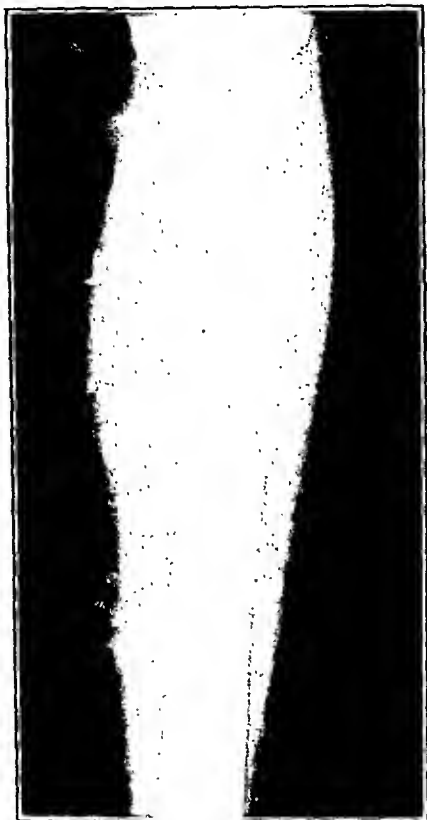


Fig. 3.

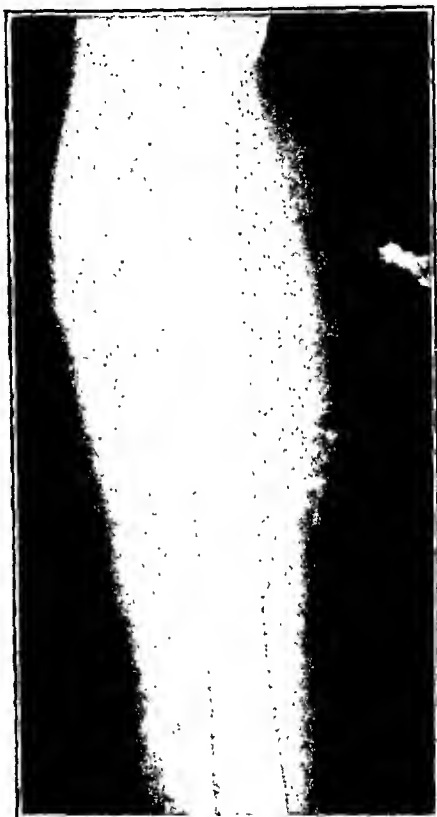


Fig. 4.

Fig. 3.—Circulation through communicating vein and up into the deep vein in multipara in tenth month, one minute and twenty seconds following injection of uroselectan. Double positive Trendelenburg.

Fig. 4.—Downward circulation in varicose vein of multipara in the tenth month immediately following injection of 0.6 c.c. uroselectan. Single positive Trendelenburg.

ficial varicose veins. Pictures taken twenty and eighty seconds later show the uroselectan scattered through varicose veins all around the leg to the ankle and still staying there.

It should be evident that in this pregnant patient with severe varicose veins, in the standing position there was no upward flow in these veins to be impeded by round garters.

But can the round garters obstruct the upward flow in the deep veins?

Again the answer is "no." I know because I have applied a tourniquet very tight, much tighter than a patient would think of wearing a garter, and yet the opaque medium is carried away in those deep veins so rapidly that it is difficult to take an x-ray quickly enough to catch it on the plate. The deep veins are buried too deeply near the interosseous membrane under pads of thick muscle of the calf and thigh to be affected by the pressure of round garters.



Fig. 5.—An old but effective relief of varicose veins. Compare the round garter.

As far back as 1844, Colles invented a vein truss, which was a spring, encircling the thigh like a hernia truss but with the pressure pad over the saphenous vein near the fossa ovalis to relieve varicose veins by shutting off and thereby relieving the downward pressure from above. He noted that this was particularly useful in pregnant women.<sup>32</sup>

It was an old trick for years for clinicians treating varicose veins to apply strips of adhesive around the leg, like a firm, round garter.

Complete obstruction of the superficial veins by ligation, has been

known to improve them rather than to make them worse. It was practiced by Paulus of Aegina, 660 A.D.,<sup>33</sup> Ambrose Pare, 1579,<sup>33</sup> by Velpeau,<sup>33</sup> and Trendelenburg.<sup>33</sup> Berntsen<sup>4</sup> in patients with a single positive Trendelenburg obtained improvement in 80 per cent by high ligature, and Jeannel obtained thus a complete cure in 28 per cent of 83 patients. Closing off the lumen of the vein above, did not cause venous dilatation below, it cured the varicose veins! More recently de Takats has been able to check the progress of the development of varicose veins in pregnant women by this same method.<sup>34</sup>

The intelligent patient cannot help being confused when the surgeon specializing in varicose veins applies pressure over the veins, or even ligates them, while her obstetrician forbids the possible obstructive pressure of round garters!

It is conceivable that in patients with a tendency to edema, round garters may be tight enough to obstruct lymphatics and make the edema worse; but I have been speaking of varicose veins. I want to mention also that superficial veins around the foot have a very active circulation upward.

My own opinion is that in the normal person in the standing position round garters may have a theoretical effect in obstructing a sluggish upward venous flow through superficial veins; but I doubt whether this is of much importance. I have never found any evidence to prove that varicose veins have been so caused. In the patient who already has severe varicose veins, I am sure that round garters not only do her no harm but may be of important benefit to her.

The incontestable mass of evidence of cures of the veins, by complete obstruction by ligating the vein makes me reluctant to forbid round garters to pregnant patients who already have varicose veins.

Did we never hear of straining out the gnat and swallowing a camel; some obstetricians meticulously forbid round garters and then order an elastic stocking!

#### TREATMENT OF VARICOSE VEINS IN PREGNANCY

Objection to treatment of varicose veins in pregnancy is very old. Ambrose Pare wrote of them in 1579 "women with child are commonly troubled with them by reason of the heaping together of their suppressed menstrual evacuation. It is best not to meddle with such as are inveterate for of such being cured there is to be feared a reflux of the melancholy blood to the noble parts whence there may be danger of malignant ulcer, a cancer, madness or suffocation." Pigeaux warned of a case of abortion in a cook, following the bandaging of varicose veins.<sup>35</sup>

It was therefore a surprise when McPheeters<sup>36</sup> had the courage to read a paper vigorously urging the injection of varicose veins of pregnancy. His paper was based on a series of 46 patients. Most of them had had pain beginning in the fourth month of pregnancy, in some cases so severe as to

make them partial invalids. Most were treated within a period of ten days in the fifth month. Ninety-two per cent were relieved, and 89 per cent said that under similar circumstances they would wish their friends so treated. It was urged: First, whatever relieves pain cannot be called meddlesome obstetrics; secondly, elastic stockings are unsanitary and linen mesh bandages will not stay on above the knee; thirdly, injection treatment is harmless and by obliterating the varicose veins may prevent the occurrence of phlegmasia alba dolens.

If a pregnant patient is in serious pain or discomfort I see no objection to allowing relief by the simple expedient of injecting the veins. As to the question of preventing milk leg by previous varicose vein injection I know by clinical experience that varicose veins do develop phlebitis with a frequency not found in normal veins. However, phlegmasia alba dolens most often begins in the deep veins of the leg and later involves the superficial veins. General treatment of varicose veins of pregnancy as a prophylactic against phlebitis would not be advised.

In the majority of light cases it is preferable to wait till after delivery and see if the varicose veins will not regress spontaneously. However, the treatment is indicated in patients with serious distress during the fourth to seventh months of pregnancy.

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## CONGENITAL PNEUMONIA OF THE STILLBORN AND THE NEWBORN\*

JOSEPH KALDOR, M.D., BROOKLYN, N. Y.

*(From the Department of Obstetrics and Laboratories of the Israel Zion Hospital)*

**I**N CONSIDERABLE numbers of stillborn as well as newborn children who do not survive more than a few hours after birth, sufficient cause for death is often not found.

Thomson tried to ascertain the most prevalent pathologic causes of stillbirth by way of a widely distributed questionnaire but found that most diagnoses were not made on the evidences of autopsies. The macroscopic findings of McDowell's autopsies on stillborns were more illuminating however, inasmuch as he showed that 23½ per cent of his cases died of pathologic conditions found in the lungs. Still more interesting is the report of Hook and Katz who reported that in twenty-two cases of congenital pneumonia, only two could be diagnosed on the gross pathologic findings, whereas in the rest of the cases the evidences of pneumonia could be found only by microscopic examination.

Within twenty-one months of the years 1929 and 1930, thirty-nine cases of stillbirths and early deaths of newborn children were surveyed by me with the following result: Six were macerated fetuses which did not lend themselves to further investigation. Nine were premature stillborns and did not show any other pathology save that of underdevelopment and marked general debility. Two were stillborns showing severe malformations of the central nervous system (encephalocoele) and two cases revealed cerebral and intraperitoneal hemorrhages respectively.

In 3 of the remaining 20 cases the lungs were of dark walnut color, especially in their posterior aspect, liver-like in consistency and from the cut surface of these dark firm parts, a granular material could be scraped off with the knife, so that the macroscopic diagnosis of bronchopneumonia could be made. In these three cases unfortunately, no histologic examinations were done. However, in view of the fact that two were stillborn and one infant lived only seven hours, there can hardly be any doubt about the fact that these three cases of pneumonia were of congenital origin.

The remaining 17 cases were examined histologically and 9 out of this group were diagnosed as pneumonias. In the other 8 no inflammatory changes were present. The individual reports follow:

CASE 1.—The alveoli were distended and filled with serous exudate, massive amniotic material and occasional desquamated cells. The blood vessels and septa showed margination and beginning emigration of leucocytes. Diagnosis: aspiration, incipient pneumonia.

CASE 2.—The lung was fairly well aerated, but the alveoli were separated by broadened septa. The septa showed hyperemia and leucocytic infiltration. Many

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\*Read before the Brooklyn Gynecological Society on May 6, 1932.

alveoli were plugged with cellular exudate. Similar exudate was present in the bronchi. Amniotic matter was found in the alveoli and bronchi. Diagnosis: aspiration; bronchopneumonia.

CASE 3.—Identical with the previous, but larger foci of pneumonic infiltration. Diagnosis: aspiration, bronchopneumonia.

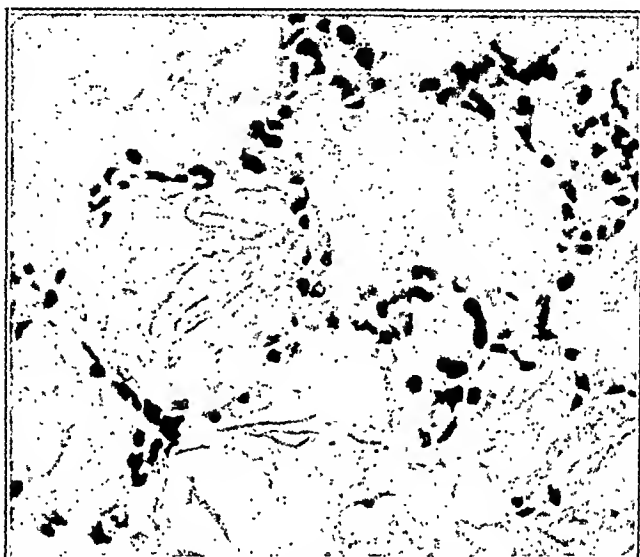


Fig. 1.—Distended pulmonary alveoli filled with amniotic material.



Fig. 2.—A section from a case of congenital pneumonia, showing a small bronchus filled with purulent exudate.

CASE 4.—Only a few alveoli contained air; the others were collapsed or filled with cellular exudate, mostly of polynuclear kind. Many of these intraalveolar plugs enclosed amniotic material. The larger bronchi were filled with purulent exudate in which amniotic material was present. Diagnosis: aspiration; coalescent bronchopneumonia.

CASE 5.—Diffuse hemorrhagic infiltration of the lung, with almost complete obliteration of the pulmonary structure was present. Numerous amniotic scales were embedded in the structureless substance. In some places there was an accumulation of cells, some of which were polynuclear leucocytes, others 'wandering cells with distorted nuclei. Diagnosis: aspiration; hemorrhagic infiltration; focal bronchopneumonia.

CASE 6.—Engorgement of the blood vessels and diffuse hemorrhagic infiltration of the lung tissue. The alveoli contained besides blood and desquamated cells also large amounts of amniotic material. Diagnosis: aspiration; hemorrhagic infarction.

CASE 7.—The capillaries as well as the larger blood vessels were engorged; the lung was partly atelectatic. The aerated alveoli contained some coagulated albuminous matter in which amniotic scales were seen. Diagnosis: atelectasis; congestion; aspiration.

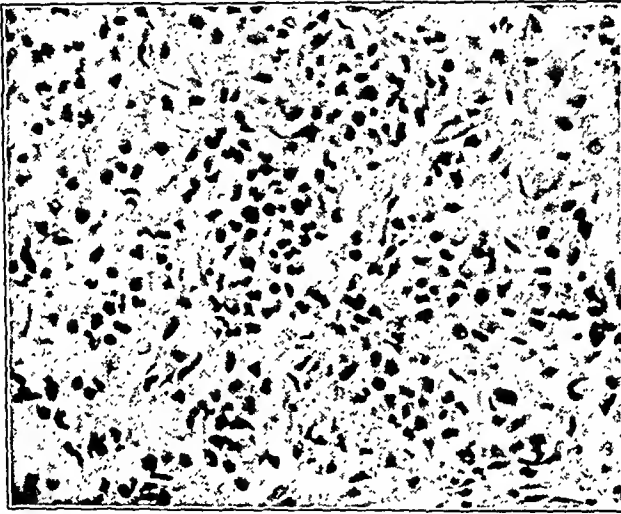


Fig. 3.—A section from a case of congenital pneumonia, showing catarrhal exudate and massive amniotic material in the alveoli.

CASE 8.—Only partly aerated lung tissue was seen. No evidence of inflammation. Amniotic matter was present in the alveoli. Diagnosis: partial atelectasis; aspiration.

CASE 9.—The capillaries and the larger blood vessels were engorged. There was no evidence of inflammation. Unusually massive amniotic matter was present in the alveoli. Diagnosis: atelectasis; aspiration.

CASE 10.—The alveoli were filled with desquamated epithelium and occasional leucocytes. Abundant amniotic material was also present and cellular infiltration of the septa. Diagnosis: aspiration; catarrhal bronchopneumonia.

CASE 11.—The lung was atelectatic almost throughout. There were a few alveoli however, containing a fibrinous exudate with a few leucocytes. Cellular infiltration of the septa was seen. Only a very few amniotic scales were found in the alveoli. Diagnosis: atelectasis; bronchopneumonia.

CASE 12.—Areas of atelectasis alternated with well distended alveoli. The latter were plugged up with abundant amniotic material. There were only occasional cells within the alveoli. Diagnosis: aspiration; atelectasis.

CASE 13.—The alveoli were collapsed. The capillaries and the larger blood vessels were engorged. There was no amniotic matter in the alveoli. Diagnosis: atelectasis.



CASE 14.—Atelectatic areas alternated with distended alveoli. The latter contained albuminous coagulated material. Diagnosis: atelectasis; edema of lungs.

CASE 15.—The alveoli were mostly collapsed. The septa showed cellular infiltration with polymorphonuclear leucocytes. A few amniotic scales were found only in the larger alveoli. Diagnosis: atelectasis; incipient pneumonia.

CASE 16.—The lung was almost completely aerated. Abundant amount of amniotic matter was present in the alveoli. There were a few leucocytes in the septa but no exudate in the alveoli. Diagnosis: aspiration.

CASE 17.—Parts of the lung were similar to the previous one. In other parts however, there was extensive infiltration of the septa and the alveoli were filled with cellular exudate. The bronchi contained much pus and desquamated cells. Diagnosis: aspiration; focal bronchopneumonia.

Summarizing our findings we observed that out of 39 full-term still-borns and early deceased children evidences of pneumonia were obtained

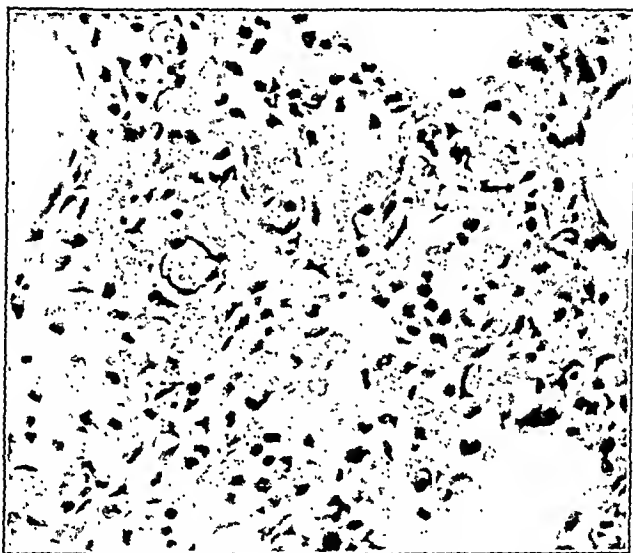


Fig. 4.—Interstitial inflammation in a case of congenital pneumonia. Broadened inter-alveolar septa infiltrated with polynuclear and mononuclear leucocytes.

in 12. Nine were diagnosed *only* by the microscopic examination, an incidence of 52 per cent, high enough to indicate the absolute advisability of examining histologically the lungs of every stillborn and early deceased newborn where the lack of gross autopsy findings leave the death unexplained.

Amniotic matter, such as scales, fat and lanugo were found in various amounts in the bronchi and alveoli of 13 cases, that is, an incidence of 76 per cent. These 13 cases included those 9 cases that showed evidences of pneumonia and 4 other cases where no signs of inflammation could be found. The fact that no case of pneumonia was observed which did not show the presence of aspiration material supports the belief that aspiration is, if not the sole, at least the most important etiologic factor in the development of congenital pneumonia. Farber and Sweet have

shown the relation of aspiration of amniotic sac contents to intrauterine asphyxia and report the presence of amniotic matter in 88 per cent of their cases.

As to the pathogenesis of congenital pneumonia, Bochencki, Groebel, Lubarsch, Viti, Durante, Menetrier and Touraine believe that the infection is a hematogenous one. Despite the fact that a diseased condition of the placenta or any lesion of the membrane could not be found by them, they base their theory on the fact that the mother has suffered shortly before or during labor from an infectious disease. Although bacteria may travel through the placenta (Raineri) and cases are on record, as for instance that of O'Connor's, where a child died thirty hours after its birth from streptococcus pneumonia, whose mother was found to be suffering from sinus disease. Although the possibility of a



Fig. 5.—Bronchitis, peribronchial, and perivascular distribution of the inflammatory process in a case of congenital pneumonia.

blood stream infection cannot be denied as in congenital syphilis, yet from the definite pathologic evidences as shown above, and will be discussed further in this article, we believe that intrauterine pneumonia as a rule is not brought about by an infection through the circulation.

In those cases that are reported in the literature where the mother has been suffering with bronchopneumonia or lobar pneumonia and on autopsy of the child a similar condition was found, the assumption that the child received an aerogenous infection immediately after birth can be entertained.

According to Murit, the pneumonia toxins of the mother, upon reaching the fetal lungs through the placenta, may set up a susceptibility to bacterial invasion and of late Lauche explains the development of the unspecific congenital pneumonias on an allergic basis.

The majority of authors however, as Silberman, Tingle, Lehman, Johnson, O'Connor, Hook and Katz, et al., favor the belief that seems also to us not only as the more plausible but also as the verified pathogenic cause. Namely, that most pneumonias in the newborn, develop intrauterine and are of bronchogenic origin.

For a long time the question was undecided as to whether the fetus performs any intrauterine breathing or not. Ahlfeld was the first to observe this occurrence with the aid of graphic tracings and Walz asserts that intrauterine breathing is a necessary aid to the fetal circulation. But Schmitt does not consider that the suction caused by the expanding and contracting thorax is of any proved assistance at all to the venous circulation in the adult, and it therefore seems of still less importance in the fetus. Present day opinion is, that under normal and healthy conditions intrauterine breathing of the fetus does not occur. However, under abnormal circumstances it may manifest some irregular breathing and from that, aspiration will result unavoidably. Obstetricians are familiar with the short and snappy inspiration that the child will sometimes draw on the intrauterine manipulation of the accoucheur's hand.

According to Bartholomew, Dyroff and others, the same factor that elicits the first inspiration and lusty cry in the delivered healthy baby, may cause if present under abnormal conditions, untimely breathing. This factor is the  $\text{CO}_2$  accumulation in the fetal circulation. An excess of  $\text{CO}_2$  in the child's blood may result from reasons originating in the mother, placenta or cord. Circulatory disturbances of the mother, due to pneumonia, decompensated heart lesions, tuberculosis, anemia, drugs, anesthetics as well as tetanic contractions of the uterus, premature separation of the placenta, placenta previa, compression of a low implanted placenta by the baby's head, infarct of the placenta, knots of or pressure on the cord and loops around the neck, all may raise the level of the  $\text{CO}_2$  above normal and become a stimulant to the respiratory center. This physiologic action of the  $\text{CO}_2$  gains practical therapeutic application in Henderson's treatment of asphyxia with "Carbogen," which is an aeriform mixture of 7 per cent  $\text{CO}_2$  to 93 per cent oxygen.

In our own 12 cases of congenital pneumonia we found the mother suffering from mitral stenosis and asthma in 2 cases, the child born in breech presentation with the application of forceps to the aftercoming head in 3 cases, and in another 3 cases the labor was exceedingly prolonged, having from forty to sixty hours in the first and from twenty to thirty hours in the second stage. In one case the child was born in asphyxia livida and in the 3 remaining cases the labor as well as the delivery was normal and uneventful.

Beside the fact that the child in utero may aspirate due to lack of oxygen, two pathologic findings are irrefutable proofs that congenital

pneumonia is bronchogenic in origin. One is that aspirated matter, composed of hornified epithelial cells, fat, lanugo, meconium particles, is found in the bronchi and bronchioli as well as in the alveoli. The second is that these alveoli are no longer collapsed as in an atelectatic state but are opened up just in such a manner as the air pressure unfolds them in the course of breathing. It would be difficult to imagine that a hematogenous transmission of bacteria into an atelectatic lung should cause the evolution of the alveoli in the aforesaid manner.

The larger bronchi as a rule rarely show any congestion or inflammation with mucopurulent discharge. The reason for this is probably, that the pathogenic agent, which besides being a chemical rather than a bacterial irritant, reaches the lung tissue suddenly, passing through the bronchi rapidly.

If signs of pneumonia are found in the stillborn, its intrauterine development is unquestionable and the designation of "congenital" is warranted. The same is vindicated if the pneumonia in an early deceased child is found in such advanced stage of its progress that it is incompatible to the length of time the child has lived. As for example, in Cases 2, 4, 17, where the span of life was from four to seven hours respectively, yet the microscopic report showed the inflammatory process of undoubtedly longer duration.

Hook and Katz term those pneumonias that are found in the stillborn as congenital pneumonia. Those that are found in the early deceased children and show findings of amniotic or birth canal matter they call aspiration pneumonias. They classify them in this manner in order to differentiate them from other aseptic pneumonias that develop from other reasons such as, infected umbilical cord, faulty respiration due to cerebral trauma or food aspiration caused by dyspeptic disorders. However, we differ with the designation of aspiration pneumonia in the case of the early deceased child whose cause of death has been pneumonia with findings of amniotic fluid. We feel these pneumonias too were undoubtedly contracted intrauterine and therefore should also be termed congenital pneumonias.

From a differential diagnostic point of view, pneumonia alba is not easily mistaken with congenital pneumonia. In the latter no chronic inflammatory changes of the septa, connective tissue proliferation or granulation tissue with chronic cellular infiltration of the vessels can be seen, nor can any spirochetes be found.

We are not ready to answer the question with absolute assurance as to whether congenital pneumonia is the cause of death in the stillborn, because it cannot be determined to what degree the breathing surface of the lung can be impaired without becoming insufficient to maintain life, yet we feel that if it is the only ascertainable pathologic finding it shall be accepted as the cause of fatality.

The clinical diagnosis of congenital pneumonia in the stillborn is of course impossible. In short lived children either no constitutional reaction is found or symptoms of a more or less pronounced bronchopneumonia are present. However, a presumptive diagnosis can be made if in conjunction with the auscultation and percussion findings, the history reveals such birth complications as have been enumerated previously and especially so, if the child was born in asphyxia livida or showed from the beginning embarrassed, irregular or weak respiration.

The occurrence of congenital pneumonia in normal cases of childbirth, as in three instances of our series, where the labor was short and the delivery was void of any complications whatsoever, shall be noteworthy for both the obstetrician and to executives of forensic medicine. A thorough microscopic examination of the lungs may often absolve the obstetrician from responsibility in the stillbirth or early death of the infant and may also avoid serious errors of indictment in suspected infanticides.

#### CONCLUSIONS

1. Congenital pneumonia was found in one-half of the cases of stillborn and newborn children that showed no other cause of fatality.

2. Three-quarters of the cases showed the presence of aspiration matter in the lung tissue. Because of the fact that such aspiration material was always present in the cases of congenital pneumonia, it is assumed that aspiration is responsible for the inflammation and together with atelectasis may be the cause of death.

3. Congenital pneumonia is bronchogenic in the vast majority of cases.

4. The advisability of a microscopic examination of the lungs of stillborn and early deceased children is stressed.

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## DISCUSSION

DR. CHARLES A. WEYMULLER.—Every baby who has cyanosis must be suspected of having congenital pneumonia. Obviously intracranial hemorrhage and suprarenal hemorrhage must be considered as well. In an extensive clinical study of this type of lesion we have been able to collect about 60 instances. The only possible means of diagnosing them has been by the x-ray. Clinically, even though there are definite x-ray findings, no physical findings can be elicited. The collapse-syndrome found in the early days of life is no different in intracranial hemorrhage, intrathoracic lesions and suprarenal hemorrhage, or so slightly different that it is impossible to make a diagnosis. The question always arises, when there are abnormal shadows in the x-ray film, as to whether they are due definitely to an inflammatory lesion of this type, or whether perhaps they are due to aspiration of noninfectious material. It is entirely impossible, if the patient lives, to know whether that was true or not. Generally, we suspect that babies who have an intrauterine pneumonia will show a diffuse peribronchial density through the lung field, instead of the massive consolidations that are present in the so-called bronchial plug of atelectasis type.

DR. JOSEPH KALDOR.—In regard to Farber's and Sweet's studies I desire to say that in their paper they simply show the relationship and find an association between atelectasis and aspiration. Furthermore, they have developed a certain staining technique with which they not only can show up these hornified epithelial cells, fat and lanugo in the alveoli, but also the vernix caseosa as a vernix membrane.

## SUBACUTE BACTERIAL ENDOCARDITIS AS A COMPLICATION OF PREGNANCY

WILLIAM F. MENGERT, M.D., PHILADLPHIA, PA.

*(From the Department of Obstetrics and Gynecology, State University of Iowa)*

THE infrequency of subacute bacterial endocarditis as a complication of pregnancy prompts the report of two cases occurring on the Obstetrical service of the University Hospital during the past five years.

Subacute bacterial endocarditis was first recognized as a clinical entity in 1852. Osler,<sup>30</sup> in his Gulstonian Lectures based on a series of two hundred cases, credits W. S. Kirkes as the first to give an unmistakable account of the disease, while he himself first organized and gave a comprehensive picture of the entity. Subsequently, an enormous volume of writings on the subject has emerged from many pens.

Blumer<sup>2</sup> notes that subacute bacterial endocarditis usually occurs in the third decade of life in patients who have had antecedent diseases producing heart damage, and seems to select those having well compensated valvular lesions. Its onset is insidious and the course prolonged, hence the name coined by Schottmüller in 1910, "Endocarditis Lenta." Although a streptococcus, usually viridans, is the infecting organism in an overwhelming majority of cases (95 per cent), a small number are caused by other organisms, chiefly the influenza bacillus. The outcome is almost always fatal in three to eight months. Osler emphasized the cardinal diagnostic features: fever, the existence of an old valve lesion, embolic phenomena, and positive blood cultures. These criteria are excellent, and with the possible exception of the history of an old valve lesion, should all be present to justify a diagnosis.

In the light of these criteria most of the cases reported as complicating pregnancy are readily determined to be endocarditides of other types. Walser<sup>11</sup> gave an excel-

lent review of the literature in 1928 from the standpoint of pregnancy complication, added two cases, and said, "The only definitely positive case found was the case reported by Findley in which the causative organism was isolated. . . ." A review of some of the supposed cases, LeGendre,<sup>4</sup> Burgess,<sup>1</sup> Norton,<sup>9</sup> Canssade and LeRasle,<sup>3</sup> shows them to be atypical. Osler's<sup>10</sup> four cases are not given in sufficient detail to enable one to judge of their true identity, and even Croom's<sup>4</sup> case, though rather convincing from the standpoint of the anamnesis, is lacking in two particulars; proof of the causative organism, and of embolic phenomena: Kobacker<sup>7</sup> and Reid<sup>12</sup> reported undisputed cases in 1930. The available and definite reports of subacute bacterial endocarditis accompanying pregnancy are: Findley<sup>5</sup> 1921, Walser<sup>11</sup> 1928, Reid<sup>12</sup> 1930, and Kobacker<sup>7</sup> 1930. To these are added the following two.

### CASE REPORTS

**CASE 1.**—White primigravida, aged twenty-one, was admitted to the University Hospital November 20, 1930, in the sixth lunar month of pregnancy, apparently in good health. The last menstrual period occurred during the first week of May, 1930. The patient gave a history of scarlet fever at the age of five, and at fourteen years she had lobar pneumonia with empyema followed by drainage and extremely painful swelling of the knee, ankle, wrist, and elbow joints, necessitating a total period of six weeks' bed rest. Three weeks after getting up she developed a cough, dependent edema, and became short of breath. Following recovery from this episode she remained well until the present time.

*Physical Examination.*—The patient was a well developed and nourished woman, normal except for a slightly enlarged thyroid, an operative scar on the right side of the thorax, and a markedly enlarged heart with the left border 15 cm. from the mid-sternal line. There was a double aortic murmur and the apex first sound had a slapping quality with a suggestion of presystolic roughening. There was no edema of the extremities, moisture in the lungs, or any other sign of cardiac decompensation.

*Antepartum Course.*—There was a daily remittent fever rising each evening as high as 100° to 102° F. Blood cultures taken December 13, 16, 22, and 26 showed nonhemolytic streptococci which grew both aerobically and anaerobically. A catheterized specimen of urine on January 6, 1931, showed chemical and microscopic blood, and small petechiae were found in the lower left conjunctiva and on the right palmar surface.

*Labor.*—On January 20, two months after admission, she went into labor spontaneously and after an eighteen hour first stage, controlled by energetic administration of morphine and scopolamine, was delivered by breech extraction of a 2558 gram normal female child.

*Postpartum Course.*—Immediately following delivery the patient's temperature rose to 102° F. and during the rest of her postpartum course fluctuated between 102° and 103° F. During the second week after delivery the spleen became palpable and tender and more petechiae were found in the conjunctivae. Examination on the seventeenth postpartum day showed normal involution of the pelvic structures despite the febrile puerperium. The uterus was about twice the size of the nonpregnant organ, and the adnexa and the parametria were free. Twenty-one days after delivery the patient was transferred to the medical service where her course was a continuation of the immediate postpartum period. Blood culture again showed a non-hemolytic streptococcus. She developed an abscess of the left labium majus in the region of Bartholin's gland and was returned to our service for its drainage. She was discharged March 4, 1931.

*Follow-Up.*—A letter from the patient's home physician said, ". . . After her return from the hospital I did not see M—— P—— until April 24. At this time she was suffering from an extreme degree of cardiac failure. . . . On May first

I saw her again on account of a small painful infarct of the left forefinger. Soon after this there were multiple infarcts, the most serious being into the right kidney. . . . The kidney was markedly enlarged and painful, and the urine was loaded with blood and casts of all descriptions." The patient's father wrote that she died on May 18, 1931, six months after her admission to the hospital.

The baby left the hospital in good condition and when last heard of, August 11, 1931, was in good health. No blood cultures were taken.

**CASE 2.**—A white, twenty-seven-year-old patient was admitted to the University Hospital September 5, 1927, in the ninth lunar month of her fifth pregnancy complaining of malaise, afternoon fever, and sweating for more than four weeks. She had been restless, had lost weight, and had pain in the right side of the abdomen. Her general health had been good, except for measles, parotitis, and tonsilitis some years earlier.

*Physical Examination.*—The left border of the heart was 12 cm. from the mid-sternal line, and there was a loud rough systolic murmur at the apex transmitted to the left axilla. The sclerae were definitely yellow.

*Antepartum Course.*—There was a remittent fever ranging as high as 103° F. A blood culture and a Widal test were negative.

*Labor.*—On September 11, six days after admission, labor began spontaneously and was terminated after a first stage of six hours by breech extraction. The child was a normal 3006 gram female.

*Postpartum Course.*—The temperature continued as high as before labor, but the remissions were less marked. Four days after delivery the spleen was palpable and very tender, and there was tenderness over the left kidney region. Another blood culture taken at this time was negative. Pleurisy developed in the left chest and the patient showed a loss of memory. Eight days after delivery the urine became grossly bloody, and chemical and microscopic tests for blood were markedly positive. Two days later the edge of the liver was palpable and tender, and the patient was transferred to the medical service. Blood cultures taken October 12, 17, 18, and 19 showed *Streptococcus viridans*. On November 1, 1927, fifty-one days after delivery, the patient died.

*Autopsy.*—November 1, 1927. Heart: The mitral valve had a group of cauliflower, friable vegetations on each leaf. Spleen: This organ was enlarged, weighing 610 gm. There was a recent infarction, 9 cm. at its greatest diameter, in the upper pole and several smaller infarctions, one of which had broken down to form an abscess. Kidneys: The left kidney showed an old depressed scar 3 cm. long, probably representing a healed infarct. Genitalia: completely normal. *Streptococcus viridans* was grown from the vegetations on the mitral valve, and cultures taken from the heart's blood showed the same organism.

The baby was discharged on the twenty-eighth postpartum day apparently in good condition, and weighing 3524 gm. No blood culture was taken.

#### COMMENT

Each of these patients had the two most important features of subacute bacterial endocarditis, repeated positive blood cultures, and embolic phenomena. Case 1 satisfies all of Osler's criteria, while Case 2 did not have definite evidence of previous heart damage. She gave a history of tonsilitis, measles, and parotitis, and had a mitral lesion on admission, but we have no certain knowledge that the heart damage existed prior to the onset of her terminal illness.

Curiously, both babies presented by the breech, but this was surely a coincidence. No blood cultures were taken from the infants, so it is im-



possible to add to Walser's<sup>11</sup> observation of placental transmission of the infecting organism. However, they survived and were normal in all respects as long as they were under observation.

The infecting organisms were *Streptococcus viridans*, and a non-hemolytic streptococcus.

In view of the grave prognosis of subacute bacterial endocarditis, we did not feel justified in Case 1 in interference of any sort, believing that delivery by the most conservative means after full dilatation of the cervix, with plentiful use of morphine and scopolamine during the first stage, offered the best chance for the child without adding appreciably to the mother's risk. We could see no advantage in abortion, believing that the mother's chance for survival would not be improved and that it was justifiable to await a living child.

Delivery did not affect the course of the disease materially, and neither patient developed infection of the uterus or parametria. This absence of involvement of the genital organs in the presence of a known blood stream infection is confirmed by Walser's<sup>11</sup> and Findley's<sup>5</sup> cases. The patient whose case was reported by the latter rallied for two weeks after delivery, dying later in uremia, and neither of Walser's<sup>11</sup> patients developed any evidence of uterine or parametrial involvement. Kobaeker's<sup>7</sup> patient was delivered by cesarean section in a successful attempt to obtain a living child. The mother was in a desperate condition and died four days later. At postmortem examination the site of the uterine incision showed "extensive necrosis and infective degenerative changes with resultant loosening of the sutures."

Reid's<sup>12</sup> case is not given in sufficient detail to add materially to these observations. His patient aborted at the fifth month of her sixth pregnancy during the course of a febrile disease from which she died five months later. "*Streptococcus viridans* was present in the blood cultures both in life and at the necropsy."

#### CONCLUSIONS

Subacute bacterial endocarditis does not seem to affect the course of pregnancy, labor, and the puerperium materially.

Pregnancy complicated by subacute bacterial endocarditis should be allowed to proceed to normal conclusion because the mother's course is almost certain to terminate fatally, and it is extremely doubtful if sacrifice of the child contributes, even in the smallest way, to her chance of survival.

Delivery by the most conservative means possible after full dilatation of the cervix with plentiful first stage analgesia is the obstetric treatment of choice.

Cesarean section is justified only in the interest of the baby when the mother is in extremis.

The babies seem to do well if they are not too premature at birth.

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## HEART-BLOCK IN PREGNANT WOMEN

J. P. GREENHILL, M.D., CHICAGO, ILL.

IN THE November, 1931, issue of the AMERICAN JOURNAL OF OBSTETRICS AND GYNECOLOGY appeared an article on "Normal Pregnancy in a Patient With Preexisting Complete Heart Block" by R. S. Titus and W. B. Stevens.<sup>1</sup> The authors reported a case of complete heart-block in a pregnant woman and stated they could locate published reports of only four similar cases that had been permitted to go through to full term. The purpose of my communication is to point out five additional reported cases of heart-block, not all of whom had heart-block before pregnancy supervened, and to place on record a case which recently came under my observation.

The first case of complete heart-block complicating pregnancy which was reported in the literature was the one described by H. Freund<sup>2</sup> in 1918. His patient was an octipara who developed Adams-Stokes symptoms one and a half hours after having had a miscarriage. She died suddenly a few hours later with symptoms of complete heart-block. Autopsy revealed both an acute and a chronic endocarditis. The author had observed signs and symptoms of heart-block during the seventh pregnancy, but the patient had no symptoms during the interval between the seventh and the eighth gestations. Freund therefore was of the opinion that pregnancy and labor exercised a detrimental influence on the conduction system of the heart.

The second case was reported by Walz<sup>3</sup> in 1922. A primipara was perfectly well until 1918 when she became ill with influenza and as a consequence of it developed heart trouble. From that time her pulse was very slow, and she had frequent fainting attacks. Not until she became pregnant did she notice any improvement. When first examined by Walz, the patient's radial pulse was 40 per minute, whereas the venous pulsations in the neck were approximately 80 per minute. Pregnancy was uneventful and labor was easy and spontaneous. The first stage lasted five hours and the second only thirty-five minutes. The child weighed 3150 gm. (6 pounds 15 ounces). During the puerperium the pulse never rose above 40 per minute. The patient left the hospital nine days after delivery. Electrocardiograms were taken and showed a complete heart-block.

Another case not included in Titus and Williams' paper, (most likely because their paper was written before this case appeared in print and because the heart-block did not manifest itself until after labor) was that reported by P. Herskovics<sup>4</sup> in April, 1931. A primipara had had polyarthritis at the age of fifteen, and since then had suffered with symptoms referable to the heart. During her pregnancy however, she had no cardiac symptoms and her pulse was 84 per minute. She had a spontaneous labor and delivered a child weighing 2700 gm. (5 pounds 15 ounces). Fifteen minutes later the placenta was expelled. Twenty-five minutes afterwards the patient suddenly cried out, became pale, manifested epileptiform contractions of both arms and then became cyanotic. The pulse varied between 13 and 15 per minute

and in spite of all medication and mechanical efforts the patient died. At autopsy the only abnormalities found were in the heart. The heart muscle and the valves were normal but in the region of the Aeshoff-Tawara nodes, at the opening of the coronary sinus was a small cavity from which two drops of thick, yellowish, purulent secretion could be expressed. The probable etiology was a bacterial-metastatic or a rheumatic infection. This produced no disturbance during pregnancy but labor had such a deleterious effect on it that it caused fatal heart-block.

Two more cases of complete heart-block were reported by McIlroy and Rendel<sup>9</sup> in an extensive paper on "The Problem of the Damaged Heart in Obstetrical Practice." The description of these patients is as follows: "Complete heart-block. Two patients, one suffering from congenital heart disease and left bundle-branch block and the other from myocardial degeneration. Both these patients did very well, the first one not showing any signs of failure. The second patient had slight disability during her first pregnancy, but has just gone through another with very few symptoms and has had twins. This patient however, had three Stokes-Adams attacks immediately after delivery."

Among the eleven cases reported in the literature (Freund, Walz, Jeannin and Clere,<sup>5</sup> Laubry,<sup>6</sup> Dressler, 2,<sup>7</sup> Herrmann and King,<sup>8</sup> Herskovics, Titus and Stevens and McIlroy and Rendel, 2, there were two deaths (Freund and Herskovics).

#### AUTHOR'S CASE REPORT

Mrs. J. K., a primipara, aged thirty-five years, had a negative family and personal history except that she knew she had an unusually slow pulse rate ranging around 50 per minute. In spite of being married seven years, this was her first pregnancy. Her last menses began July 20, 1930, and conception was believed to have occurred on July 27. Quickening was observed December 10, 1930. When first seen by Dr. W. E. Brown of Cedar Rapids, Iowa, the patient's pulse was only 50 per minute. Because of this he referred her to Dr. B. F. Wolverton who, from physical examination and electrocardiographic studies, made a diagnosis of complete heart-block associated with rheumatic heart disease and mitral insufficiency. The electrocardiograms are shown in Fig. 1. Because of the repeated fainting attacks and periods of marked bradycardia the patient was admitted to the St. Luke's Methodist Hospital in Cedar Rapids on March 24, 1931. On admission the heart action was irregular. The apex and radial pulse rate averaged about 48 beats per minute whereas the jugular pulse rate was 90 per minute. The left border of the heart was  $4\frac{1}{2}$  inches to the left of the midsternal line. The apex was 4 inches to the left of the midsternal line in the fifth intercostal space. The right border was one inch to the right of the midsternal line. A diastolic murmur was heard at the apex and was transmitted to the axilla. The blood pressure was 110 systolic and 60 diastolic. The lungs were clear. The liver and spleen were not palpable. The uterus was the size of an eight months' pregnancy, the presentation was O.L.A. and the fetal heart rate varied between 140 and 160 per minute. The urine was normal except for the presence of acetone. The pelvic measurements were normal.

After admission to the hospital, the patient's condition became worse. She fainted more frequently, she was frightened a great deal of the time, and she was restless, dizzy, and weak. The pulse varied between 32 and 40 but the auricular rate remained around 80. An electrocardiogram showed complete dissociation. The blood pressure gradually rose. On April 7, the systolic pressure was 160 and the diastolic pressure 70 and on April 11, the systolic was 180 and the diastolic 80. There was no evidence of aortic insufficiency. Another electrocardiogram taken on April 9, when the blood pressure was 170 systolic and 76 diastolic revealed no changes. The QRS wave in both tracings was 10 mm. Lead I showed no axis deviation and no conduction deficit in the bundle branches or the ventricles. At one time the pulse went as low as 18 per minute. The medication consisted of digifolin, barium chloride

and adrenalin. On April 13 I was called to Cedar Rapids by Dr. Brown to perform a cesarean section. At the beginning of the operation the pulse was 52 and it remained almost the same throughout the operation. The blood pressure at the beginning was 150/80 and it varied between 142/80 and 180/84. I performed a transperitoneal, cervical cesarean section (laparotrachelotomy) and used local anesthesia not only for the cesarean section but also for the sterilization operation, which consisted of crushing and doubly ligating the tubes according to the Madlener procedure. The baby which weighed 2310 gm. (5 pounds 1 ounce) was in excellent condition. Convalescence was entirely uneventful. The patient was permitted to sit up in a chair on the twelfth day after operation, and she and her baby left the hospital in good condition on the fifteenth day. During the puerperium the pulse varied between 29 and 43 beats per minute and the blood pressure was normal. The highest temperature was 100.8° F. and this occurred on the third postoperative day.

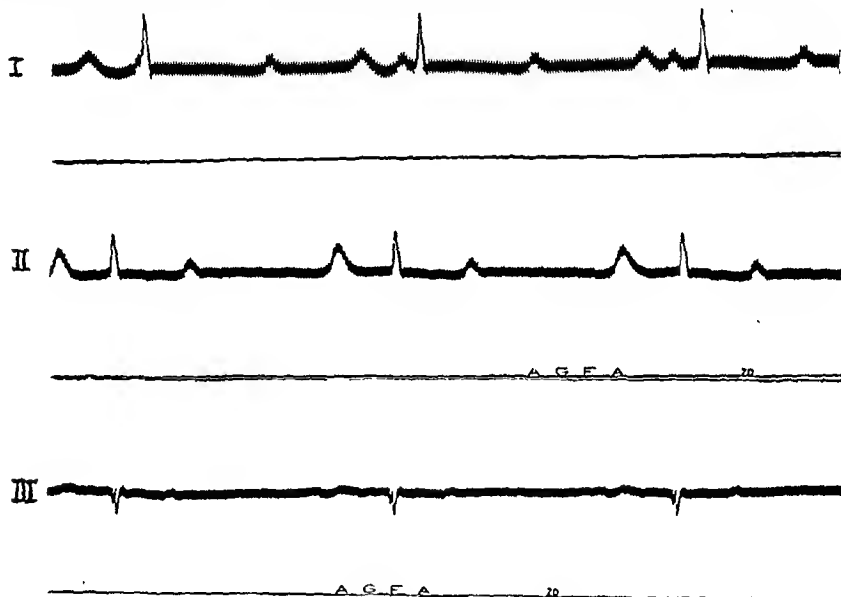


Fig. 1.

## COMMENT

Heart-block complicating pregnancy is a rare and serious condition. Of the twelve cases reported in the literature including the case herein described, there were two fatalities, a death rate of almost 17 per cent. Undoubtedly many more cases of heart-block in pregnancy have been observed but have not been reported. As Titus and Williams point out, heart block during pregnancy is extremely rare in women who had the block before pregnancy supervened. Probably one of the reasons for this is that heart-block usually occurs in individuals over forty years of age. On the other hand, it is not very uncommon to observe heart-block during pregnancy, labor, or the puerperium as a temporary condition in women who do not have the heart-block at any other time. In every case of heart-block complicating pregnancy, labor, or the puerperium, a cardiologist should be called in consultation by the obstetrician. In patients with perfect compensation and without untoward symptoms delivery through the natural passages should yield

good results for both mother and child. The second stage should be shortened in primiparas by means of a low forceps operation under direct infiltration anesthesia of the perineum and vagina. In women with evidences of decompensation the low cervical cesarean section under local anesthesia before labor sets in is the safest procedure.

I wish to thank Dr. W. E. Brown for the details concerning the case and also for the excellent care he gave the patient after operation.

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185 NORTH WABASH AVENUE.

### SOME UROLOGIC COMPLICATIONS IN THE FEMALE\*

G. KOLISCHER, M.D., CHICAGO, ILL.

THE interest that gynecologists in recent years have taken in urology makes it opportune to bring up for discussion a few instances where the results of modern investigations help to supplant routine treatment with rational therapy. Formerly and to a certain extent even today under the term incontinence was applied to clinical manifestations of entirely different origin. Now we know how to differentiate pollakuria and imperative urinary frequency based on inflammatory processes of urination, from true incontinence based on insufficiency of the sphincter muscle. I am not going to discuss the extreme cases of complete incontinence where on account of total destruction of the sphincter transplantation of fasciae and muscles has to be resorted to, but will confine myself to those cases of relative incontinence in which any increase of the abdominal pressure leads to dribbling or complete evacuation of the bladder.

In juvenile individuals resistance gymnastics practiced with a straight urethral sound as a rule is followed by good results. The resulting hyperplasia of the sphincter muscle may be evidenced by digital palpation, the strengthened sphincter muscle to be felt as a protruding ridge.

In older patients whose reconstructive power is somewhat impaired this procedure may fail. Then we resort to a rather simple endovesical method. Employing an operative or catheterizing cystoscope a fine electrode is introduced into the bladder and running a cutting current a few superficial incisions are made into the mucosa, these incisions extending about 1 cm. into the bladder and reaching just as far into the urethra. We use about the same technic as employed in the linear cervical incisions for endocervicitis. It is advisable to establish these incisions in the upper half

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of the so-called vesical neck and not in the vesical trigone, in order to avoid unpleasant after effects. If the first seance should not prove successful, the procedure may be repeated. Local anesthesia with a 10 per cent novocain or a 4 per cent antipyrin solution makes this method absolutely painless.

Strictures of the female urethra although given more attention than formerly, nevertheless are quite often overlooked because the fact is lost sight of that their presence, location and extent may with certainty only be diagnosed with the help of an olive tipped sound. In this connection I would like to call attention to a complication which is rather frequent and if overlooked may cause pronounced inconvenience if a certain routine treatment is administered. It is common practice to follow dilatation of the urethra with instillation of concentrated silver salt solutions in order to alleviate the symptoms of a supposed cystitis. In fact in a great many instances one finds concomitant with stricture, a retrostrictural edema of the vesical trigone. The trigonal mucosa appears to be whitish and fluffed, imitating the appearance of absorbent cotton. Such a vesical lining is rather vulnerable and reacts very unfavorably to any caustic. Systematic dilatation of the urethra as a rule suffices to restore normal circulation and epithelialization. In stubborn cases medical diathermy is very helpful in restoring normal conditions.

Gonorrheal urethritis in the female quite often subsides spontaneously if reinfection is avoided, but occasionally it may assume a chronic character, thus not only being bothersome but also furnishing a fruitful source of infection for other pelvic organs. Whenever one encounters a chronic urethritis with copious discharge urethroscopic examination should be undertaken. In such instances one finds disseminated granulations of the urethral mucosa generally located over the opening of the urethral glands. Scrapings of these granulations demonstrate a meshy structure whose cavities are filled with gonococci, explaining the stubborn character of urethritis of this kind. Electric destruction through an urethroscope furnishes prompt and lasting relief.

Another source of great annoyance are varicose veins in the vesical mucosa. Sizeable varicosities may not only be productive of submucous and open hemorrhages but in many instances cause intolerable itching sensations within the bladder. This symptom may be explained by the slowing up of the local circulation and also by the loss of the epithelium over the venous nodules similar to the sensations around surface varicosities. Formerly these varicosities were not amenable to endoscopic therapy and in extreme cases one had to resort to cystotomy and excision or destruction of the dilated veins with the actual cautery, either one an operation of importance. Nowadays we are in a position to obliterate these nodules by applying the high frequency current through a cystoscope, a simple and safe procedure the same as the destruction of a benign papilloma. Local or sacral anesthesia guarantees a painless procedure.

Omission of cystoscopic and functional examination may in another instance be responsible for a therapeutic error. It is a rather common occurrence that especially in young females during the course of a toxic or bacterial nephritis, submucous hemorrhagic patches are established in the vesical mucosa, which are apt to produce various disagreeable symptoms.

If these conditions are not recognized and, as is so often the case, urotropin or similar drugs are administered, the whole situation is aggravated. In some individuals such medication is apt to produce vesical hemorrhages though nephritis may not be coexistent. But if such patches are already present this medication accentuates the pathology and pronounced hematuria with concomitant extensive loss of epithelium is apt to occur. In all instances of this kind antinephritic régime has to be instituted and any local treatment of the bladder has to be omitted.

In doing prolapse operations or hysterectomies, the operator may miss the proper cleavage and open the bladder wall while freeing the viscus from its attachment to the portio. The resulting interference with the circulation produce then areas of epithelial desquamation in the base of the bladder, causing disagreeable symptoms. If without cystoscopic control the usual diagnosis of postoperative cystitis is made and instillations with irritating solutions are administered the syndrome is aggravated. The epithelialization of these defects takes place spontaneously as soon as proper circulation is reestablished. Mild diathermic treatments are apt to accelerate this restoration. It seems that in prolapse operations the detachment of the bladder not only from the cervical junction but also laterally from the broad ligaments is of importance. In order to dispose of the retention in an extensive cystocele it seems to be necessary to bring the entire bladder under the influence of abdominal pressure. If however the lateral detachment of the bladder is neglected, a double saddle bag formation of the bladder will result. In this way urinary retention with all its undesirable sequelae will be the result.

The troublesome occurrence of pyelitis in the female has become somewhat mitigated, by the introduction of intravenous urography. This enables us to visualize the urinary ways without the vitiation by artefacts produced by retrograde pyelography. Systematic revision of the results obtained by pelvic lavage in pyelitis lead some observers to the conviction that this method is only indicated and successful in the instances of a dilated pelvis. Visualizing the renal pelvis by retrograde pyelography does not enable us with certainty to differentiate a dilated pelvis from a dilatable one. In the latter instance repeated instrumentation is apt to produce irritation and aggravation of the symptoms. This is especially true in pregnant women.

Another item may be mentioned which though not strictly urologic in the usual sense in medicine, is the occurrence of certain nephrotic conditions. The latter constitute most of the renal disturbances in pregnant women. As a rule they do not constitute an indication for interruption of

pregnancy and usually will subside under proper régime after delivery. The term nephritis is used for capillary toxicosis of the kidney and its sequelae, while the pathologic renal substratum in nephrosis is degeneration of the tubular epithelium without involvement of the glomeruli. Nephritic conditions are characterized by the retention of the organic metabolic end products, nephrosis is accompanied by disturbances of the lipoid economy of the body and the retention is confined to the inorganic end products. Nephritic edema contains proteins and no chlorides, nephrotic edema is characterized by high chloride contents without proteins. In gynecologic operations nephrosis may assume great importance. For some as yet unaccountable reasons nephrotic patients are very prone toward the establishment of pneumococcus infections. Perfectly clean laparotomies may in such instances lead to death on account of postoperative pneumococcus peritonitis. Timely diagnosis and appropriate treatment may prevent such infaust accidents.

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## THE USE OF ADRENALIN IN THE TREATMENT OF ACUTE INVERSION OF THE PUERPERAL UTERUS, WITH REPORT OF A CASE

JOHN A. URNER, M.D., PH.D., MINNEAPOLIS, MINN.

*(From the Obstetrical and Gynecological services of the General Hospital and the Department of Obstetrics and Gynecology of the University of Minnesota)*

THE work of Huntington, Irving and Kellogg (1928) and the recent paper of Irving and Kellogg (1931) upon the reposition of the acutely inverted puerperal uterus by laparotomy, has again called attention to this serious complication of labor.

Because of the rarity and the high mortality of the condition, as shown in Findley's (1929) recent paper, it would seem justifiable, in spite of the fact that a large series of cases is not available from which one could draw definite conclusions, to report any adjuncts to the accepted method of treatment.

It is admitted that the greatest immediate danger in the treatment of the acutely inverted puerperal uterus lies in attempts at replacement through a contracted cervix, in the presence of shock that almost always accompanies the condition. The generally accepted procedure is to control bleeding, replace the uterus in the vagina and treat shock by all available means, with the idea that later the replacement may be carried out with minimal danger to the patient.

It has been pointed out, however, by Findley and others that this delay may result in contraction of the cervix and subsequently defeat all efforts at replacement. The contracted cervix, then, presents a barrier to either manual or operative replacement. The treatment must be directed toward an alleviation of this spasm of the cervix when the patient is in condition to withstand the trauma of replacement.



Rucker (1925, 1927, 1931) has described the effect of adrenalin upon the human uterus and has shown that 5 minim doses of 1-1000 solution caused a cessation of labor pains for a period of nine to thirty minutes in 16 out of 20 patients. In addition, he had used adrenalin successfully in the treatment of contraction ring dystocia and in difficult deliveries demanding uterine relaxation.

Rudolph and Ivy (1930) have demonstrated that adrenalin injected into dogs in labor, produced a temporary relaxation of the uterus which lasted for three to ten minutes. They also found that it inhibited the contractions produced by ergotamine tartrate and pituitrin.

Ivy, Hartman and Koff (1931) in experimenting with the ante- and postpartum uteruses of the monkey found that the injection of adrenalin produced a single uterine contraction which was followed by a relaxation period of five minutes or longer. They confirmed the work of Rudolph and Ivy as to the effect of adrenalin upon the contractions induced by pituitrin.

With the foregoing in mind the following case report is submitted:

Mrs. E. O., aged twenty-five, para ii, gravida iii, was admitted to the obstetric service of the General Hospital at 8:00 A.M., in early first stage labor. The cervix was about 2 cm. dilated and the membranes had ruptured before admission.

Physical examination revealed no abnormalities. The pelvic measurements were adequate. The position was O.L.A. Pains were moderate but continued with increasing intensity and duration until 9:00 P.M. when she went into second stage labor. At 11:42 P.M. she was delivered of a normal living child. There was minimal bleeding after the second stage which was controlled by gentle massage of the uterus.

At 12:05 A.M. there was a sudden hemorrhage in which approximately 1500 c.c. of blood were lost. An attempt was made to massage the uterus to contraction to permit Credé expression when it was noted that the placenta, membranes, and uterus were at the vaginal outlet. The patient went into shock as her blood pressure dropped to 80 systolic. No diastolic reading could be obtained. Her pulse increased to 160 and was hardly perceptible. The placenta and membranes had to be separated in order to replace the uterus into the vagina. At this time the cervix was found to be contracted down to about 2 cm. in diameter. The patient was quickly placed in Trendelenburg position and pituitrin and caffeine sodium benzoate were given. External heat was applied. The bleeding at this time had stopped; 1500 c.c. of saline were given intravenously which raised the blood pressure to 110/60. The pulse rate lowered to 140 and was of fair quality.

The patient was transfused with 550 c.c. of whole blood. The blood pressure rose until at 1:00 P.M. it was 138/96. The pulse had slowed to 100. Her condition had greatly improved.

At 1:00 P.M., thirteen hours after the inversion, the patient was surgically prepared for manual replacement of the uterus. Atropine sulphate gr. 1/150 was given preparatory to gas-ether anesthesia. She was catheterized. Five minutes before the vagina was entered  $\frac{1}{2}$  c.c. of adrenalin was given intramuscularly. The blood pressure rose to 140/88, the pulse increased to 120. Vaginal examination showed the uterus to be firmly contracted and the cervical ring not more than 2 cm. dilated. It had the consistency of cartilage. Pressure in the sulcus gave little hope of reposition. Steady pressure was made against the inverted fundus with closed fist and within one minute (six minutes after the adrenalin was given), it began to soften on its posterior surface. The cervix relaxed to about 4 cm. in diameter. At this time (1:25 P.M.) an additional  $\frac{1}{2}$  c.c. of adrenalin was given. The blood pressure remained at 140/88 and the pulse rate at 120. Within one minute the cervix relaxed enough to admit the closed fist and without further difficulty the uterus was completely replaced. An intrauterine pack was placed by hand. The blood loss during the operation was not more than 150 c.c.

Immediate transfusion of 450 c.c. of whole blood was given. The pack was removed in twelve hours. During the puerperium the temperature rose to 100.2° on the second, third, and fourth days. The patient was discharged from the hospital on her sixteenth postpartum day with a well involuted uterus and in good general condition.

#### SUMMARY AND CONCLUSIONS

The intramuscular injection of adrenalin in this case of acute inversion of the puerperal uterus seems to have been effective in producing relaxation of the uterus and cervix and to have greatly facilitated manual replacement. There is little doubt of its value in protecting the patient from further shock during operation.

It is suggested that adrenalin is a valuable adjunct in the reposition of the acutely inverted puerperal uterus by either manual or operative method.

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2615 PARK AVENUE.

## A CASE OF LARYNGEAL DIPHTHERIA COMPLICATING THE PUERPERIUM

J. HERSH, M.D., PITTSBURGH, PA.

FREQUENT mention is made in the literature of puerperal diphtheria, diphtheritic patches being found upon the denuded portions of the vulva and vagina. These are usually a primary genital infection and texts refer to them as sometimes being secondary to diphtheria of the throat. However, a search of the literature for cases of pharyngeal or laryngeal diphtheria complicating the puerperium reveals infrequent mention of the same.

Steen in 1900 reported a case of a woman aged thirty-three well advanced in pregnancy who had a sore throat and nasal discharge. The next day she had a slight membrane on her right tonsil, no pyrexia, and no enlarged glands. Her pulse rate was accelerated and a bacteriologic examination showed the Klebs-Loeffler bacillus. She was given 1500 units of antitoxin and the next day delivered a full-term infant. When the child was four days old it developed difficult nasal breathing and the next day, membrane on its right tonsil. The child was given a total of 1350 units of antitoxin and recovered.

E. Casavecchia in 1901 reported a case of a gravida ii, para ii, twenty-four years of age, who in the eighth month of pregnancy was suffering from diphtheritic laryngotracheal bronchitis. She was given Behring's antidiphtheritic serum in 1000 unit doses and after the fifth injection of serum, the patient delivered a living fetus weighing 2500 gm. The serum was repeated three times and the patient recovered.

D. R. Ranson in 1909 reported a case of a pregnant woman contracting diphtheria from her two children, having diphtheritic membrane in her throat. The woman was given 4000 units of antitoxin followed by 3000 in twelve hours. Ten hours after the second injection her child was born and took the breast, although her membrane and fever remained. The child did not contract the disease and the mother recovered.

I am reporting a case of laryngeal diphtheria complicating the puerperium, this case being unusual in that for three days prior to delivery, the patient had a sore throat. There was no membrane visible at the time and after the development of a clinical virulent laryngeal diphtheria, there was still absence of membrane. This sore throat was not accompanied by any increased temperature or pulse rate and when the disease manifested itself clinically about thirty hours after delivery, a diagnosis was immediately made and heroic measures of therapy instituted but without avail.

Mrs. P. O'H., aged forty-two, gravida vii, para vii. First day of last menses March 24, 1931. Her past medical history is not significant except for pyorrhea alveolaris a year ago for which she had all her teeth removed. The patient's mother died of heart disease in late adult life, and otherwise her family history is negative.

During her present pregnancy she had occasional transitory headaches and attacks of dizziness and swelling of her feet and ankles. She had attacks of gas after eating and was bothered by constipation. Her physical examination was essentially negative except for tenderness in the region of her gall bladder, and her blood pressure and urinary examinations were negative throughout her present pregnancy. On December 11, 1931, while making an antepartum visit to the patient's home, she remarked that her two sons, aged eight and ten respectively, were suffering from tonsillitis which had abated but had left them with "sore glands" in their necks. I looked at the boys but found nothing except some enlarged anterior cervical glands, both their throats being clear. The patient was warned at the time to take great care in not exposing herself to any acute infections as she was very close to term.

The patient was admitted to the Montiflore Hospital December 30, 1931, at 12:45 A.M., stating she had had several labor pains. On examining her in the labor room she remarked that three days ago her maid had a very sore throat and she helped out by doing her own housework. That same evening her throat became sore and had bothered her ever since. Examination of her throat revealed a slight injection of her pharynx on the left side. Abdominal and rectal examination showed her to be in definite labor and the sore throat was forgotten.

At 2:49 A.M., the patient delivered spontaneously vertex L.O.A., a male child weighing 3880 gm. There was a small first degree tear of the fourchette. The expulsion of the placenta was Schultze spontaneous and the bleeding was slight. The patient had sodium amytal grains VI during the first stage of labor and ether for her perineal stage. She was returned to bed in good condition.

About twelve hours after delivery the patient's pulse, temperature, and respirations were normal. She was feeling fine except for her sore throat. Examination at this time showed some increased inflammation of the left tonsil with a small pus pocket. Her throat was painted with 10 per cent silver nitrate and a gargle prescribed.

Early the following morning, December 31, 1931, at 12:30 A.M., the patient was awakened by her sore throat which kept her uncomfortable during the whole night. Toward daylight she began to have increased expectoration, difficulty in swallowing, loss of voice, not being able to talk above a whisper, some dyspnea and

difficulty in bringing up thick tenacious mucus which choked her. She also complained of a sticking pain deep in her throat pointing to the region of the cricoid cartilage. At 12:40 P.M., her temperature was 102.8°, pulse 148, and respiration 24, and Dr. Friedman of the Nose and Throat Department was called in to look at her larynx. The indirect laryngoscopic examination showed a swelling of the false cords and an entire absence of any false membrane either in the larynx or throat. We were greatly concerned about the possibility of a laryngeal diphtheria, therefore, a direct smear and culture were taken of the patient's throat, and it was decided that if the smear were to be negative for the diphtheria bacillus we would still give the patient a large dose of antitoxin before waiting for the culture report.

The laboratory examined the direct smear immediately and found *B. diphtheriae* in large numbers. The patient was immediately given 95000 units of diphtheria antitoxin intramuscularly, was removed from the obstetric floor and isolated. The patient was given 500 c.c. of 10 per cent glucose intravenously about one-half hour after the administration of the antitoxin. Since the newborn had been exposed to a seemingly virulent case of diphtheria, he was given a prophylactic dose of 1500 units of antitoxin and also isolated.

Toward evening the patient was becoming more toxic and breathing more difficult. A second examination of the larynx showed such large amount of swelling of the false cords that a view of the true cords was entirely obliterated, and the presence of any false membrane not observed. Dr. J. S. Baird, the Director of the Municipal Contagious Hospital, was called in consultation, and at 10:15 P.M. he intubated the patient because of her marked respiratory difficulty. The intubation immediately relieved her dyspnea and improved her pallor, but she continued to expectorate a now blood stained mucus which was very annoying to her. Morphine and atropine sulphate were given in small repeated doses and the patient spent a very restful night.

The next morning the patient's condition was fair. She was taking liquids in teaspoonful doses and in order to give her more fluid to combat her toxicity 1000 c.c. of 10 per cent glucose was started intravenously. Although the administration was not rapid after 840 c.c., it was stopped because of dyspnea and cyanosis.

Late that afternoon the temperature began to drop, the pulse going up and becoming weak and thready. The patient did not respond to cardiac stimulants, the pallor increased and an acute pulmonary edema supervened. The heart continued to fail and the patient died at 9:00 P.M. The intubation tube was removed post-mortem and was found free of obstruction and with a small piece of membrane adhering to its lower pole, the first seen throughout the whole course of the disease. The membrane was cultured in the laboratory and gave a growth of *B. diphtheriae*.

#### COMMENT

This case is presented in detail because it has many interesting features. I mentioned the sore throat in the patient's two boys occurring nineteen days before her delivery, and the sore throat in her housemaid three days before delivery, as a possible etiologic factor. Her entire family were therefore immediately cultured, including the housemaid, but with negative results. There was no diphtheria in the neighborhood where the patient lived, and none of her friends or relatives had knowingly been exposed to the disease. Several friends who had visited the patient the night before the onset of the laryngeal symptoms, submitted to culture as well as all the hospital personnel who had contact with the patient, with negative results.

From the reports in the literature the infection of a mature adult woman in the puerperal state with laryngeal or pharyngeal diphtheria, is very rare. This is a chance infection, yet since it does occur, and with such tragic consequences as in this case, it should be kept in mind.

The question of giving the newborn a prophylactic dose of diphtheria antitoxin was quickly decided upon, even though they are thought to inherit a transient congenital immunity. If there was a lack of this immunity in the mother, surely the chances of the infant inheriting such immunity would be obscure. In Steen's case the infant developed diphtheria when four days old, and G. Blechmann and M. Chevalley report two infants contracting the disease from an older infant who was not isolated. They believe that diphtheria is not observed under seven months of age because of relative isolation and not inherited immunity.

Another clinical feature that cannot be overlooked in this case is the cardiac death. I previously mentioned the patient's history of pyorrhea alveolaris and the presence of a mild chronic cholecystitis. These coupled with seven pregnancies that in themselves deplete the cardiac reserve, offer enough undermining of myocardium to make it unable to advantageously withstand the virulent toxin of diphtheria.

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445 UNION TRUST BUILDING.

### QUININE INSUFFLATION TREATMENT OF TRICHOMONAS VAGINALIS. PRELIMINARY REPORT

JULIUS H. SURE, M.D., AND JAMES E. BERCEY, M.D., MILWAUKEE, WIS.

(From the Department of Obstetrics and Gynecology, Mt. Sinai Hospital)

THE fact that *Trichomonas vaginitis* is a clinical entity and of not infrequent occurrence is not further disputed. Our reason for bringing the subject to attention again is only that the manifold and various treatments have so far proved unsatisfactory. The antiseptics, the dyes, lactic acid, and Lassar's Paste have relieved many cases, cured a few, but the majority come back with a reinfection or recurrence shortly after a menstrual period, or, if treatment is relinquished, after some lapse of time.

It occurred to one of us (J. H. S.) that since the organism is a protozoon, and since quinine is an agent which frequently destroys some of the protozoa, this cinchona alkaloid might be useful in the treatment of such cases.

CASE 1.—H. B. P., was seen October 12, 1931, aged twenty-four, married, nullipara, complained of an irritating discharge for some length of time. *Trichomonas*

four-plus positive. This case was selected because the patient had not been treated before. No cleansing, scrubbing, or antiseptics were used.

The specimen recovered from the patient was studied under the microscope. A small quantity of quinine sulphate powder was mixed with water and allowed to trickle under the cover glass. Immediately the organisms were thrown into a spasm. Several minutes later, the motility and activity of the organisms were seen to diminish and then stopped entirely after a short length of time. Long, narrow crystals, shaped like disorganized cordwood appeared under the microscope, which crystals we learned to recognize as those of quinine.

Quinine sulphate powder, about fifteen grains, was blown into the vagina with a powder blower, and patient asked to report the following day. Next day, specimen taken from the same patient showed many quinine crystals and many dead (non-motile) trichomonads.

Daily insufflations and study of slides showed less and less purulent discharge with disappearance of the trichomonads on the fourth day after the initial treatment.

Patient was not seen for a week during which time she had a four-day menstrual flow. October 22, patient's vagina was perfectly dry, with no discharge, no trichomonads found. After her December 6 menstrual period, slide showed no trichomonads and no discharge. Last seen January 2, 1932, no discharge, no trichomonads, and patient dismissed.

CASE 2.—Mrs. E. W., aged twenty-five, was treated in clinic off and on from March 28, 1927, to October 13, 1931, for neisserian infection. October 13, 1931, she still complained of an irritating vaginal discharge, at which time trichomonads were discovered. Quinine used as in Case 1, October 17, and October 24. October 31, no discharge; November 7, menstruating and quinine used during period. November 14, no discharge and no trichomonads present; November 21, no burning, no itching, no vaginal discharge and no trichomonads. December 5, postmenstrual slide, no treatment, no discharge, no trichomonads. December 12, no trichomonads, no discharge, and no treatment. December 19, no trichomonads and no treatment. January 2, 1932, no discharge, no treatment, and patient dismissed.

CASE 3.—E. S., aged forty-six, was first seen March, 8, 1930, for spotting after coitus, when polypoid endocervicitis was diagnosed. Treated by actual cautery.

February 7, 1931, complained of burning discharge, and trichomonads found. Treated with soap scrub, bichloride douche. Treated at various times to September 19, 1931, with various medicaments, without any improvement. October 3, 1931, Lassar's Paste used. October 10, 1931, trichomonads still present. Quinine insufflation. October 17, 1931, no discharge for the first time in many months and no trichomonads. October 24, 1931, vagina dry, no discharge. Patient not seen since.

CASE 4.—V. B., aged twenty-seven, first entered the out-patient department October 29, 1928, for metrorrhagia and vaginal itching, dating back from a twin delivery in April 1928. The smears showed gram-positive and gram-negative bacilli with many pus cells. November 14, 1931, trichomonads discovered. Quinine insufflation as in preceding cases and 15 gr. capsules given patient, to be introduced in the vagina each night. November 21, no discharge, no trichomonads. Quinine insufflation. November 28, no discharge, no trichomonads. Quinine insufflation. December 5, vagina clean, no discharge. Quinine insufflation. January 5, 1932, no discharge, no trichomonads. Patient dismissed.

CASE 5.—E. W., aged twenty-four, first seen August 3, 1931, with leucorrhea, odor and burning. Endocervix cauterized. November 17, 1931, trichomonads found. Quinine insufflation and capsules at home for one week. November 28, 1931, no trichomonads. Quinine insufflation. December 19, 1931, postmenstrual slide showed no trichomonads and no discharge. Quinine insufflation. January 2, 1932, no trichomonads.

CASE 6.—F. K., aged fifty, first admitted August 8, 1931, for vaginal itch, burning. Menopause twelve years ago. Slides showed trichomonads four-plus and sugar in urine. Treated with sodium bicarbonate and sodium perborate. August 15, 1931, no improvement. September 18, 1931, instillation of 10 per cent mereurochrome daily, no improvement. November 7, 1931, no improvement, quinine used. November 22, 1931, no discharge; itch still present. November 28, 1931, quinine insufflation. No trichomonads found; itch still present. Urine still showed sugar and patient presently under care of medical department for diabetes mellitus.

CASE 7.—N. M., aged twenty-one, first seen November 17, 1931, complaining of discharge, burning and itching. Date of last menstrual period was November 16, 1931. Claims to have had burning and itching for six months, and had been treated before by someone else with mereurochrome and vaginal tampons. Trichomonads four-plus. Quinine insufflation. November 19, 1931, nonmotile trichomonads. Quinine insufflation. November 20, 1931, trichomonads still present and nonmotile. November 21, 1931, no discharge and no trichomonads found. Patient has not reported since.

#### COMMENT

While the number of cases is very small and no positive conclusion should be drawn from the treatment of these few instances of *Trichomonas vaginitis*, still the results so far are so good that we have no hesitancy in inviting the medical profession to try it.

#### CONCLUSIONS

Seven cases of *Trichomonas vaginitis* were reported, six of the patients having received miscellaneous treatment with no improvement. All seven improved clinically and microscopically under the use of quinine treatment.\*

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\*At present we have five additional cases under treatment with apparent equally good results.

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## BLOOD CHEMISTRY STUDIES OF NORMAL NEWBORN INFANTS

### A PRELIMINARY COMMUNICATION

#### I. BLOOD SUGAR ESTIMATIONS

ALBERT W. HOLMAN, M.D., AND ALBERT MATHIEU, M.D., PORTLAND, ORE.

THE results of our studies of the blood sugar levels in women suffering from true toxemia\* in the last trimester of pregnancy agreed with the findings of Titus.<sup>1</sup> From this fact we were led to the premise that the offspring of these women must necessarily have a hypoglycemia and that hypoglycemia must often be the cause of neonatal death. We therefore began to give, empirically, 5 to 6 gm. of glucose in 50 per cent solution to the babies of toxemic mothers, administering it by syringe into the umbilical vein. These babies seemed to do better and the mor-

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\*We use this expression to differentiate from nephritis.

tality rate of twenty babies, born alive, of toxemic or eclamptic mothers was 5 per cent, the only one which died being a seven months' child with a torn tentorium.

TABLE I

MOTHER	MOTHER'S BLOOD	BABY'S BLOOD (CORD)
1	131	103
2	90	74
3	121	78 } Twins
4	101	80
5	101	87
6	85	93
7	105	70
8	106	101
9	91	104
10	91	112
11	74	75
12	104	80
13	140	101
14	70	129
15	114	72
16	107	76
17	76	109
18	85	63
19	80	101
20	80	60
21	80	78
22	121	81
23	72	76
24	90	60
25	129	96
26	109	96
27	80	63
28	104	68
29	109	90
30	80	116
31	122	67
32	115	107
33	72	109
34	85	71
35	87	80
36	112	70
37	87	104
38	114	74
39	96	104
40	78	74
41	107	72
42	110	87
43	80	100
44	110	70
45	140	110
46	132	126
47	80	140
48	160	80
49	90	170
50	100	100
		50
	102 average	90.4 average



The next step seemed to be a quantitative estimation of the glucose in the blood of infants from toxemic mothers. Preliminary to this, however, we undertook a comparative study of the glucose in the bloods of normal mothers and their babies, at delivery.

#### TECHNIC

Before the cord was cut, a needle was inserted into the umbilical vein several inches from the umbilicus and the blood withdrawn and placed immediately into an oxalated tube.<sup>2</sup> In some instances, however, the blood was taken directly from the maternal end of the cord, after it had been cut. Simultaneously blood was drawn from the median basilic vein of the mother. The Haskins, Osgood modification of the Schaffer microcopper method of blood sugar estimation was used routinely in all tests. No blood was allowed to stand more than two hours<sup>3</sup> before the sodium tungstate-sulphuric acid filtrate was made.

It will be seen (Table I) that the blood sugar levels in this small series fall into the same general range as do adult levels. Also that in most instances, the babies' blood sugar levels were relatively the same or below those of their mothers. This would indicate that if the mother suffers from hypoglycemia the fetus probably does.

As Stander<sup>4</sup> points out, and as our work has confirmed, the toxemic mother has a lowered alkali reserve. Hence, it is reasonable to suppose that her fetus will also have a lowered alkali reserve. We are now studying the comparative alkali reserves of newborn babies and their mothers with relation to the blood sugar levels and will report our results later.

#### CONCLUSIONS

1. The majority of normal babies have blood sugar levels at birth relatively the same as, or below, those of their mothers.

2. It would appear that babies of mothers with hypoglycemia must of necessity have a hypoglycemia in the majority of instances.

3. The neonatal mortality of babies born of toxemic mothers can probably be decreased by the administration of glucose to these infants at birth.

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545 MEDICAL ARTS BUILDING.  
415 STEVENS BUILDING.

## URETERONEPHRECTOMY DURING EARLY PREGNANCY

R. B. McKNIGHT, M.D., F.A.C.S., AND REID PATTERSON, M.D.,  
CHARLOTTE, N. C.

THE surgeon is frequently called upon to operate during the course of a pregnancy. Most frequently the lesion demanding his attention is in the appendix, and next in order, the gall bladder, and then the thyroid gland. These will constitute over half of the operations of necessity during gestation. In the lesser group of cases will be found quite a variety of intraabdominal and extraabdominal surgical lesions, for which operations on the kidney constitute about 4 per cent of the whole, and roughly 10 per cent of the lesser miscellaneous group.

Schmidt<sup>2</sup> in 1915 collected 6 cases, 1 his own, in which nephrectomy had been performed during pregnancy, and in addition to Hartman's collected series of 30 cases reported in 1913, made a study of the entire group. In this group there were 2 maternal deaths, 3 spontaneous abortions, 1 induced abortion, 1 induced labor, and in 1 a dead fetus was extracted. Mussey and Crane<sup>1</sup> of the Mayo Clinic in 1927 reported a series of 370 operations of necessity performed during pregnancy over a period of ten years. In this series there were only 4 maternal deaths and 17 miscarriages. (Interestingly enough all 4 deaths followed operations on the appendix or gall bladder, and over a third of the miscarriages followed operations on the uterus (myomectomy) or on the ovary.) There were 14 operations performed on the kidney, of which only 2 were ureteronephrectomy. In this group there were no maternal deaths and only one miscarriage. They concluded that any operation can be performed prior to the fifth month of gestation without undue risk to the mother and child.

### CASE REPORT

We wish to report a case where ureteronephrectomy was performed during the first month of pregnancy, without knowledge of the patient being pregnant.

A young white girl, aged nineteen, who said she was single, was referred to one of us (Dr. McKnight) complaining of excruciating attacks of left-sided pain. Her family history was of no importance. Menses began at twelve and had always been normal and regular. She stated that her last period was just over. Her past medical history was negative except for the usual diseases of childhood, and these attacks of pain coming on at irregular intervals for the past two years. It seemed that they would appear after fairly strenuous exercise such as dancing or vigorous walking. Two months before she was first seen she had a very severe attack of left-sided pain extending from the renal area downward and inward toward the bladder and vulva. Since then she has had attacks every few days. The pain was evidently acute, as it caused her to cry out and writhe in bed and frequently required large doses of morphine for relief. She noticed no blood in the urine; although there was some urinary frequency but no pain on voiding. For the past week she had been confined to bed under morphine and symptomatic treatment, but suffering nevertheless.

Examination revealed a well developed and nourished young white woman, weighing about 110 pounds. Her blood pressure was 100 systolic and 64 diastolic; pulse 100; temperature 99.6°. Examination was negative except for marked pain, tenderness, and rigidity over the left renal area extending downward and forward over the abdo-

men toward the bladder. Pelvic and rectal examination revealed no abnormality. Her urine contained a trace of albumin and many pus cells; hemoglobin was 70 per cent (Sahli); leucocytes 26,000; Wassermann negative and blood urea 15 mg. per 100 c.c. of blood.

She was taken to the hospital where cystoscopic examination and pyelograms were made by Dr. J. P. Kennedy. The urine from the right kidney was normal, and there was normal function; that from the left contained many pus cells, and this kidney showed about 50 per cent normal function. Pyelograms showed the right kidney perfectly normal in size and position. The left ureter showed an obstruction about 20 cm.



Fig. 1.—Ureteronephrectomy during early pregnancy.

above the vesical orifice. Injection of opaque medium was followed by exposure and at the point of bifurcation this ureter showed two well formed pelvices in one cortex. It was considerably larger than the right. Left nephrectomy and ureterectomy was decided upon and was performed by Dr. McKnight. The ureters were dissected out to a point about 3 cm. below the bifurcation and there ligated and cut. The kidney was about twice the normal size and had many adhesions about it, but was freed with little difficulty and removed. The patient made an uneventful recovery and was dismissed from the hospital the fifteenth postoperative day with the wound draining a minute amount of serum. Pathologic report was double ureters and pelvices, pyelonephrosis, multiple abscesses in the parenchyma of the kidney. A catheterized urine specimen two months subsequently showed only an occasional pus cell and was otherwise normal. She had complete relief of her symptoms and had gained several pounds in weight.

About four months after her operation she called for medical attention. On questioning her she stated that she had no special trouble, but "just wanted to see the doctor as she had been married two months before operation and was a month pregnant when operated upon." She stated that she had been married during a two- or three-day period when she was free from pain, and wanted to keep it a secret from her family. Examination revealed a five months' pregnancy. She was referred to Dr. Reid Patterson for obstetric care.

Studies at this time showed an entirely normal urine, hemoglobin 60 per cent (Sahli), 3,660,000 red blood cells, Wassermann negative and blood chemistry normal. Frequent urinalyses and blood pressure determinations showed that she had a normal period of gestation, toward the end of which the urine contained a little albumin and a few pus cells in a voided specimen. She entered labor at 7:00 o'clock the morning of May 10, 1930, eight months after operation. External examination revealed irregular uterine contractions, a breech presentation, and strong fetal heart sounds with a rate of 138. Vaginal examination at 10:30 A. M. revealed a rigid cervix, two finger dilatation, membranes intact, and a breech presentation. She was given 1/6 gr. of morphine sulphate and 1/200 gr. of hyoscine hydrobromide hypodermically to insure a comfortable first stage. She continued to make good progress and when the breech was well down on the perineum, a left episiotomy was done under ether anesthesia. At 1:10 P. M. she delivered herself of a normal baby boy weighing 2920 gm. The episiotomy was repaired in the usual manner and shortly afterwards the placenta was delivered intact. There were only about 25 c.c. of blood lost in this delivery. Pituitrin and ergot were given postpartum. She reacted nicely and was removed to her room in good condition. Recovery was uneventful, and she was dismissed from the hospital the seventh day. At this time her red cell count was 4,480,000, hemoglobin 65 per cent (Sahli), and a catheterized specimen of urine showed fairly numerous pus cells and a cloud of albumin. One month later a voided specimen was entirely negative except for an occasional pus cell. Her health is now excellent, blood pressure, blood counts and urinalysis are normal. She has gained about 15 pounds in weight and has no complaints.

#### COMMENT

From a study of the scattered single case reports in the literature of nephrectomy during pregnancy, from the reports of Schmidt and of Mussey and Crane, and from observations on our own case, it would seem that there is no cause for concern in doing renal surgery during early pregnancy, provided the remaining kidney is normal as to function and infection. Following operation in such a case, there is no reason why a patient should not continue through her period of gestation as though she had two perfectly functioning and normal kidneys. It is undoubtedly the better judgment to perform nephrectomy, rather than allow the pregnancy to continue in the presence of a unilateral pyelonephrosis, with marked diminution of function, in a congenitally abnormal kidney. Such a condition would certainly augment the possibility of a severe bilateral renal infection before term. It is our belief that there are absolutely no grounds for therapeutic abortion in cases of unilateral renal disease, where, in a nonpregnant woman renal surgery would be indicated.

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PROFESSIONAL BUILDING.

## HYPERTROPHY OF THE CLITORIS: REPORT OF TWO CASES

LYMAN W. MASON, M.D., DENVER, COLO.

(From the Department of Obstetrics and Gynecology, University of Colorado School of Medicine)

THE first case, and the one serving as the basis for this report, was a schoolgirl aged seventeen years; height 64 inches; weight 125 pounds. She was seen in the Out-Patient Department of Gynecology of the University of Colorado Medical School, to which she had been referred by the medical department because of complaint of leucorrhea and pain in the right lower quadrant. The pain had no relation to her menstrual periods. Leucorrhea began about two years ago, and had increased slightly in amount since.

*Past History.*—Never any serious illnesses. Menstrual periods began at the age of twelve; frequency every twenty-eight days; duration four days; moderate flow; never any dysmenorrhea.

Patient's mother and an aunt stated that the patient had always enjoyed excellent general health; was robust; had developed normally in every respect, but that she was unduly reticent, and that she accomplished her schoolwork with considerable difficulty.

*Family History.*—Father and mother living and well, aged forty-three and forty-two respectively. One brother, nineteen, probably tuberculous. Three sisters, ages eleven, fourteen, and sixteen, all in excellent health. Other family history negative, except for one uncle who is at present a patient in a psychopathic hospital, suffering from epileptiform attacks, which he insists are due to masturbation in youth. Psychiatric diagnosis is unknown.

*Physical Examination.*—General examination entirely negative, except as noted below. Typical general feminine development and personality. Voice soft and pleasing. Normal hair development and distribution. Breasts well developed.

Abdominal examination elicited marked tenderness over McBurney's point, with some suggestion of rigidity of the right rectus. The pain complained of was attributed to occasional mild exacerbations of a low-grade chronic appendicitis.

External genitalia showed mature development. Hair growth abundant and of feminine distribution, except for a very thin line of it reaching to the umbilicus.

Labia majora normal. Labia minora were hypertrophied and redundant, hanging from a markedly hypertrophied clitoris, which was rigidly erected.

Vestibulo negative. Urethral meatus normal. Hymen perforate and unruptured. There was a copious and constant secretion from the openings of both vestibular (Bartholin's) glands. Vagina negative. Cervix negative, except for a rather profuse secretion, entirely normal in appearance. No erosion.

Uterus normal in size, in good position and freely movable. Both ovaries were palpated; they were normally situated and were of normal shape and size. Tubes not felt. No pelvic abnormalities were found.

The measurements of the erected clitoris were length, 5 cm., width at the base, 1.75 cm., and length of glans, 1.75 cm.

Following the examination, the patient was questioned regarding any autoerotic practices. These she at first flatly denied, but further indirect questioning elicited the fact that she had frequently and continuously masturbated, by stimulation of the clitoris, beginning at the age of eight. She stated that about a year ago she stopped the practice. This last statement, however, is probably not true.

Chief interest in the case was directed to the clitoris, which appeared as in Fig. 1.

Before examination, and therefore before any stimulation of the genitalia, the clitoris was rigidly erected. Only after some time at a subsequent examination did it be-

come flaccid, and then not entirely so. (Fig. 2.) The slightest touch anywhere about the external genitalia caused it to become rigidly erect, the erection occurring, as in case of a penis, by pulsations synchronous with the heart beat. Voluntary contraction of the levator ani and perineal muscles increased its rigidity and direction of erection, also as in case of an erected penis.

The clitoris was extremely sensitive. At one time while measuring its dimensions, orgasm occurred at the slight touch and pressure of the small celluloid scale used. This was entirely local in its manifestations, that is, marked by spasmodic contractions of the levators and perineal and vaginal muscles only. This lack of more general response I believe to be due to past frequent masturbation, which had accustomed the patient to the attendant sensations.

Opportunity was subsequently afforded to examine this girl's mother and her three sisters. The external genitalia in all were entirely within normal limits with the exception of the oldest sister, aged sixteen, who presented a condition almost identical with the one reported here, with the exception that she had no complaint of leucorrhea, and



Fig. 1.



Fig. 2.

it was evident that the sensitivity of the organ was much less marked than in the case of her older sister. I am informed by a colleague, who has had under his care at various times two aunts and a female cousin of these girls, that there is nothing remarkable in the development of their clitoris.

There are various pathologic processes which cause enlargement of the clitoris. However, in such cases as the one under consideration, presenting so marked a degree of "normal" hypertrophy, the condition is a congenital one, probably hereditary and probably a recessive characteristic. The mother stated that she had noticed that the clitoris of these sisters were always larger than normal. When we consider that the clitoris is a homologue of the penis, with its muscular and erectile anatomy so similar, the wonder is not that marked hypertrophy sometimes occurs, but that it occurs so infrequently.

Frequent and long continued clitoris masturbation (and almost all masturbation in the female is of the clitoris) usually causes some hypertrophy, but never to any extent comparable with that seen in the present cases. The

leucorrhea complained of is, I think, physiologic for the conditions found, with the probably quite constant reflex stimulation of the cervical and vestibular glands.

Conditions such as these bring up interesting problems in treatment. One is often in doubt as to the proper course to pursue, or the proper advice to give. There is no doubt that a condition such as has been described is undesirable. However, it might be worse. It is necessary to take into consideration more than the small portion of anatomy involved. We must consider the individual in the light of her entire personality. This is true in all gynecologic problems, and it is all too often ignored.

Sex desire and gratification are largely a matter of the psyche, and we do little to increase our patients' physical and mental health by any procedure which removes the means for gratification but leaves the desire. These cases are more frequently than not proper ones for the consideration and treatment of the psychiatrist, or more happily the gynecologist who is psychiatrist enough to know when and how to treat the minds of his patients, and when to treat their genitalia. Much harm has been done in the past, and is still being done, by such operations as circumcision, clitoridectomy, etc., for such indications as masturbation and other complaints which are dependent more upon mental factors than upon anatomical states.

Dr. Franklin G. Ebaugh, of the Department of Psychiatry, saw and examined this patient in consultation. His report in part follows:

"Psychiatric examination revealed an average adolescent girl of the dull normal type. Her general reactions in the home, the school and the community appeared to be normal, and when closely questioned she did not show any unusual or abnormal preoccupations regarding sex and the condition of the vulva. Her heterosexual interests appear to be normal. She enjoys contacts with the opposite sex but has not been unduly erotic. Her interests are typically feminine and her physical development shows the usual secondary sexual characteristics, with normal menstrual function, hair distribution, development of the breasts, etc.

"Opinion on the basis of the above examination is that an operative procedure at the present time is not indicated and may actually do harm and lead to an emotional fixation on the part of the child to the anatomical condition present. I am of the opinion that her sexual development and activities will be normal. Of course, later on in life, conditions of a physiologic or psychologic type may warrant an operative procedure."

Appendectomy was advised, and the leucorrhea explained on a physiologic basis. Since it was not markedly profuse, no treatment was considered advisable at the present. The condition of the clitoris in both cases was minimized, and nothing was advised concerning it, trusting that within a few years marriage will occur with establishment of normal heterosexual relations.

These cases are reported because of the medical interest of a rather unusual condition, and its occurrence in two members of one family; to emphasize the wisdom of considering such cases as much from a psychiatric as from a gynecologic standpoint, and to point out that ill-advised or hasty surgery is more likely to be harmful than beneficial.

## CYANOSIS OF THE NEWBORN\*

CASE REPORTS SHOWING VALUE OF X-RAY AS AN AID IN DIAGNOSIS

EDWARD H. DENNEN, M.D., F.A.C.S., NEW YORK, N. Y.

ROENTGEN rays as an aid in diagnosis of cyanosis of the newborn should be used more frequently. Intracranial hemorrhage is often accepted as the most probable cause, but an x-ray picture may show that the trouble is in the chest. Thus the physician's responsibility is lightened, and the risk of lumbar puncture is avoided. In making a differential diagnosis, the simpler procedure should be used first as it may show that the other is not necessary. The presence of one of at least five other possible



Fig. 1.

conditions may be established by the x-ray, and the treatment of each is quite different. Examples of these are shown in the following cases.

CASE 1.—*Atelectasis*: Mrs. R. W., aged twenty-three, para i, gravida ii, was admitted to the Doctors Hospital on May 21, 1931. After thirteen hours of labor, she was delivered by low forceps to an L.O.A., of a female child weighing 6 pounds and 15 ounces. There was an initial asphyxia lasting fifteen minutes. During the next two hours the baby appeared normal. Then severe cyanotic attacks developed, occurring every ten or fifteen minutes. A physical examination did not reveal enough evidence on which to base a diagnosis. An x-ray of the chest (Fig. 1) taken when the baby was six hours old, showed nearly complete atelectasis of the left lung, and only partial expansion of the right lung. The cyanotic attacks continued for fifteen hours and then suddenly ceased. During this time carbon dioxide and oxygen were given through the Henderson machine with each attack.

\*Read before the Obstetrical and Gynecological Section of the N. Y. Academy of Medicine, December 22, 1931.



A second x-ray, taken four days later, showed normal expansion of both lungs. The baby was discharged well from the hospital on the fourteenth day, and is now seven months old.

**CASE 2.—Congenital Cardiac Lesion:** Mrs. M. C., para i, aged twenty-nine, was admitted to the Harbor Hospital, April 25, 1931. After seven hours of hard labor, she was delivered of a 6 pound boy by low forceps to an L.O.A. The baby was cyanotic for several hours after birth. There were several more attacks during the next three days, and cerebral hemorrhage was feared. Then for ten days the baby appeared well, but the attacks returned and were much worse.

The heart was found to be enlarged. This led to the suspected diagnosis of a congenital heart condition. The x-ray diagnosis was the same (Fig. 2). One week later the baby died, and on autopsy the diagnosis was confirmed. There were three chambers in the right heart; a rudimentary pulmonary artery, and a large patent foramen ovali.



Fig. 2.



Fig. 3.

**CASE 3.—Pneumonia:** Mrs. R. S., aged thirty-four, para v, was admitted to Bellevue Hospital, August 17, 1931. She had nineteen hours of hard labor with an L.O.P. position. After a tentative trial with forceps, delivery was accomplished by version and breech extraction, and Piper forceps to the after-coming head. The baby weighed 8 pounds, and was markedly asphyxiated. The efforts at resuscitation were prolonged. After using the Flagg and Drinker machines for an hour, the respirations were regular but labored.

During the next day, there were several cyanotic attacks. On the second day, the attacks were much worse. An x-ray picture of the chest was taken, but before the report was returned, a lumbar puncture was done, and 12 c.c. of clear spinal fluid, under moderately increased pressure were withdrawn. At this time, the diagnosis of severe intracranial injury, with extradural hemorrhage was considered probable. Later, the x-ray report showed consolidation of the upper lobe of the right lung, and a patchy consolidation around the right root (Fig. 3). Three days later the baby's condition was much improved, and on September 11, he was discharged in good condition.

**CASE 4.—Thymus:** Mrs. J. N., was admitted to the Polyclinic Hospital October 6, 1931. She was a para ii, twenty-six years old, at term, but not in labor. Her first child was delivered by cesarean section, because of a generally contracted pelvis, with a breech

presenting. The baby developed cyanotic attacks. The diagnosis was enlarged thymus. After x-ray therapy was given, the child recovered and is well today.

At this time, a 6 pound 6 ounce baby was delivered by elective cesarean section. There was marked initial apnea. The baby was finally made to breathe with the aid of the Flagg machine, but the respirations were shallow.

An x-ray picture showed an enlarged thymus. One x-ray treatment was given, but the baby died after seventeen hours. An autopsy was done. The brain was normal. There was a moderate amount of mucus in the air passages. The thymus was considerably smaller than its shadow appeared in the x-ray plate 14 hours earlier. The lungs showed early beginning pneumonia. The remainder of the autopsy was negative.

Although the diagnosis was not substantiated by the autopsy, the case serves to illustrate one of the possible causes of cyanosis, and the method of diagnosing it. There was considerable hesitancy about presenting this case, first because of the pathologist's



Fig. 4.



Fig. 5.

findings; and second, because of the discussion among authorities as to whether the thymus is really a pathologic entity in these cases.

**CASE 5.—*Diaphragmatic Hernia:*** Mrs. M. S., para i, aged nineteen, a private patient of Dr. Hawks, was admitted to the Polyclinic Hospital August 4, 1931, in labor at term. She was delivered after eleven and one-half hours of labor because of the disappearance of the fetal heart, by mid forceps to an R.O.A. The baby weighed 6¼ pounds and was in good condition.

On the seventh day, the baby developed cyanotic attacks, with rapid and irregular respirations. The diagnosis of intracranial hemorrhage was accepted as most likely, and the condition was treated as such. The next day an x-ray of the chest was suggested, but the baby was considered too sick to be moved to the x-ray room.

The responsibility for this condition was placed upon the physician by the father of the child because of the forceps delivery. Later, an x-ray picture was taken which showed a left diaphragmatic hernia, with the intestines in the left chest (Fig. 4). As her condition was steadily getting worse, the baby was operated upon successfully on the thirteenth day by Dr. Coryllos. The postoperative x-ray showed normal lung expansion but the heart had not yet returned to the left chest (Fig. 5). The baby was discharged well after six weeks, and is now in good health at four months of age.

All these cases of cyanosis in the delivery of which I had some part, occurred during a period of six months, showing to some extent the relative frequency of this condition. All were seen by consultants, and in only one was the correct diagnosis made before an x-ray picture was taken, showing the difficulty in making a diagnosis, and the value of x-ray aid.

Intracranial hemorrhage was not the primary diagnosis in all, but in the absence of other evidence, it had to be considered as a possibility. Although an autopsy may reveal a condition which relieves the doctor of the responsibility of intracranial hemorrhage, it also shows, in some instances, that had an x-ray picture been taken, and the indicated treatment been given, death might have been prevented. If no autopsy is obtained, the real cause is often not known, but the weight of medical opinion may force the doctor to sign the death certificate as intracranial hemorrhage. So both of these embarrassments may often be avoided by the early aid of a simple, flat x-ray picture of the chest, regardless of the baby's condition, or how sure one may be of his diagnosis.

133 EAST EIGHTIETH STREET.

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## RUPTURE OF A CORPUS LUTEUM AS A CAUSE OF ACUTE ABDOMINAL SYMPTOMS\*

### CASE REPORTS

WAVERLY R. PAYNE, M.D., F.A.C.S., NEWPORT NEWS, VA.

**D**URING the past two years I have had occasion to operate on two instances of this condition, both being positively diagnosed by pathologists.

CASE 1.—E. B., aged twenty-three, colored, married five years but never pregnant, called me on January 5, 1930, because of severe abdominal pains. Her past history was negative. Her periods were regular, every twenty-eight days, the last one ending one week previously. On several occasions she had had slight pains in the left lower quadrant, but never severe. On the occasion of the present attack during coitus she was seized with a sharp agonizing pain in the left lower quadrant, which radiated across the entire lower abdomen. She became nauseated but did not vomit. There was no vaginal bleeding. Examination revealed a well developed, and well nourished young Negro woman writhing in pain. Her temperature was normal, pulse 100, heart and lungs negative. The lower abdomen, especially on the left, was extremely tender and rigid. Morphine,  $\frac{1}{4}$  grain was given, and an additional  $\frac{1}{6}$  grain before relief was obtained. Vaginal examination was deferred until the following morning at which time the patient was much more comfortable. She was still extremely tender to pressure, and had marked rigidity in the left lower quadrant. The perineum was firm. There was no bleeding or unusual discharge. The cervix was smooth, and normal in position. The uterus was slightly displaced, backward and to the right. The right ovary was palpable, and apparently normal in size. On the left there was marked tenderness in the region of the tube and ovary where a small soft mass was felt. Catheterized specimen of urine was negative. Wassermann negative. Hemoglobin 77 per cent, R.B.C. 3,776,000, W.B.C. 6,600, polys 51 per cent, small leucocytes 45 per cent, large leucocytes 3 per cent, eosinophiles 1 per cent. The diagnosis of chronic

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\*Read at a meeting of Warwick County Medical Society, January 14, 1932.

salpingitis with left ovarian cyst was considered most logical. The cause of the acute pain was not satisfactorily explained. The patient was advised to go to the hospital at the time of the acute attack, but desired to wait until the following morning. Next morning she was more comfortable, and her general condition better. She waited two days longer before entering the hospital. During this latter interval there was no improvement in her local condition.

Operation: Under spinal anesthesia the abdomen was opened and about 200 c.c. of old blood was found in the pelvic cavity. The right tube was chronically inflamed and adherent to the right ovary which was approximately normal in size. The left tube was chronically inflamed and adherent to the left ovary which was twice its normal size, and contained a large fresh corpus luteum body through which there was a rent 1 cm. in length. The appendix was somewhat congested. Both tubes, the left ovary, and appendix were removed.

Pathologic report (Dr. Sam Budd), was as follows: Chronic salpingitis, chronic cystic ovaritis with a large fresh ruptured corpus luteum body showing on the surface. This patient had an uneventful convalescence, and left the hospital on the tenth day.

CASE 2.—Miss M. V. R., aged thirty, clerk. On April 28, 1930, while at work she was seized with a rather severe sharp pain across the lower abdomen, which within a few hours became localized in the right lower quadrant. She was nauseated, and vomited once. Her past history revealed several attacks of tonsillitis, and several attacks of indigestion characterized by gas and belching. On several occasions she had noticed soreness in the region of the appendix. Her menstrual periods were usually regular every twenty-eight days, lasting five days, accompanied by pain on the first day. Her last period began three weeks previously. Physical examination revealed a normally developed and well nourished young woman. Her tonsils were infected. Heart, lungs, etc., negative. Temperature 98.2, pulse 80, blood pressure 120/80. Examination of the abdomen revealed marked tenderness, with rigidity over McBurney's area, extending rather deep into the pelvis. Rectoabdominal examination revealed the uterus moderately displaced backward. There was marked tenderness in the right lower quadrant. A small soft tender mass was felt just posterior and to the right of the uterus. Urine was negative, Wassermann negative, hemoglobin 83 per cent, R.B.C. 4,360,000, W.B.C. 8,400, polys 51 per cent, small leucocytes 46 per cent, eosinophiles 2 per cent, basophiles 1 per cent. The preoperative diagnosis was appendicitis, and cyst of the right ovary.

Operation: Under ether anesthesia a right rectus incision was made. The appendix was easily located. It was somewhat longer than normal, and presenting in the pelvis. There were a few old adhesions, otherwise no demonstrable pathology. It was removed. The uterus was normal in size and in second degree retroversion. The left ovary and tube were normal. The right ovary was enlarged to three times its normal size, and presented numerous cysts on its surface, one of which had ruptured. There was approximately 125 c.c. of blood in the culdesac. The right tube and ovary were removed.

Pathologic report (Dr. Beeroft), was as follows: Appendix and right tube normal. The right ovary measured 3.5 by 2 by 2 cm. The surface presented a wrinkled appearance. A small opening was noted at one end, and surrounding this the tissue was blood stained. The microscopic examination of this area showed a large corpus hemorrhagicum developing in the margin of which luteal cells were seen. Recovery was uneventful, and this patient left the hospital on the twelfth day.

#### COMMENT

In the two cases reported there was a sudden onset with definite evidence of intra-abdominal pathology. Neither of these cases exhibited significant changes in the blood picture.

## ENTRANCE OF LIPIODOL INTO OVARIAN AND OTHER VEINS DURING UTEROGRAPHY

JOHN CHARLES KILROE, B.A., M.D., AND ALFRED M. HELLMAN,  
B.A., M.D., F.A.C.S., NEW YORK, N. Y.

*(From the First Gynecological Division Lennox Hill Hospital)*

**B**ELIEVING that the condition presented by the following case is still generally unknown, we herewith offer this report. No similar case report could be found in the literature up to 1932, and one of our largest clinics reported never to have seen such a case.



Fig. 1.—Roentgenogram taken directly after injection of lipiodol.

Mrs. M. N., age thirty, was born in Italy and has been in the United States for ten years. She has been married six years; has never been pregnant. Her menses started at 13, are regular, of the twenty-eight day type, and last six to seven days; the bleeding is scanty and there is no pain. For four years the menses have been becoming less frequent and more scanty. She came to the Lenox Hill Hospital Clinic because of this reduction in her menses, her seeming sterility, and complaining of some indefinite pain on the right side of the abdomen, low down.

Two examinations of the uterus and tubes by means of the injection of lipiodol into the uterine cavity demonstrated an apparent intravascularization of lipiodol into the vessels of the uterine wall, and outlined both ovarian veins. This is easily seen from the accompanying pictures (Figs. 1 and 2). Bimanual examination is entirely neg-

ative, and no direct cause for the phenomenon is demonstrable in this patient. This finding is most unusual. Robin and Schapiro in the *New England Journal of Medicine* (Vol. 205, p. 380) showed a picture of this condition which they produced by injecting lipiodol into the extirpated uterus, using great pressure. In our case on the living subject no undue pressure was used, and the process was not at all painful.



Fig. 2.—Taken three minutes after injection of lipiodol.

Three theories for the production of this phenomenon are mentioned:

1. Injection under high pressure.
2. Injection after injury of the mucous membrane of the uterine wall, as with a curette.
3. Softening and permeability of the vessel walls.

Neither of the first two reasons are applicable to our case, and no undue softening or permeability of the vessel walls could be demonstrated unless the phenomenon herewith described demonstrates that such permeability of the vessels exists.

1114 MADISON AVENUE,  
44 EAST 78TH STREET.

# REPORT OF THE RESULTS AFTER TWELVE YEARS, IN A CASE OF URETEROVESICAL ANASTOMOSIS\*

H. DAWSON FURNISS, M.D., NEW YORK, N. Y.

**A.** R., sixty-one years old, single. In August, 1919, was operated upon for large uterine fibroid. One week later developed incontinence of urine.

When first seen by me on October 15, 1919, examination revealed a vesicovaginal fistula  $\frac{1}{2}$  inch in diameter, situated just to the left of the median line,  $\frac{3}{4}$  of an inch

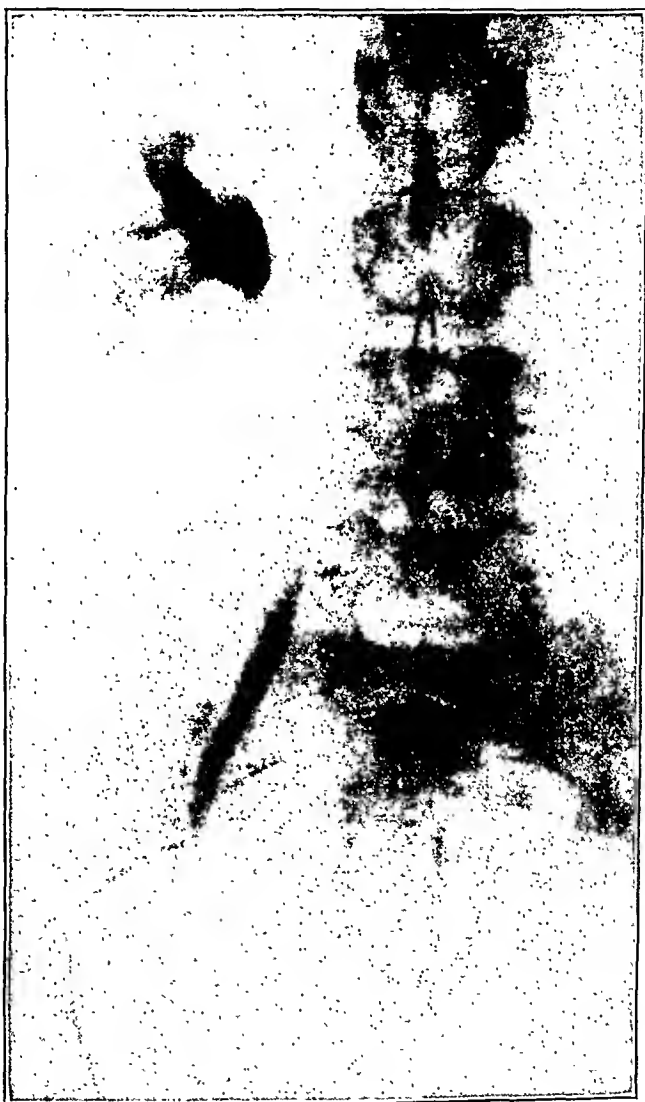


Fig. 1.

posterior to the interureteric ridge. The left ureter drained into the vagina through a minute orifice high in the left vaginal fornix. Indigocarmine was eliminated strongly from the left as well as from the right ureter.

\*Presented at a meeting of the Section of Obstetrics and Gynecology, New York Academy of Medicine, February 23, 1932.

On October 30, 1919, I implanted the left ureter into the bladder according to the technic published by me in the *American Journal of Obstetrics and Diseases of Women and Children*, 77: No. 1, 1918. On January 12, 1920, the vesicovaginal fistula was closed through the vagina. The convalescence from both operations was uneventful.

Since that time, except for hypertension, there has been no trouble. In September, 1927, her blood pressure was 250/150, and has kept at this figure since. On cystoscopy the implanted ureter appears as a minute orifice, that will admit a No. 6 catheter. Through it indigo carmine is eliminated as well as on the right, and in normal rhythm and force. On November 30, 1930, a pyeloureterogram was done. This shows only slight dilatation of the ureter, pelvis, and calyces. On January 27, 1932, phenolsulphonaphthalein was injected intravenously; in seventy minutes 33 per cent was eliminated. The urine was pus free. Only a few hyaline casts and a trace of albumin were found.

Many of the ureterovesical anastomoses are followed by ureter stricture, hydro-ureter and hydronephrosis, often associated with infection. This successful outcome is reported as a stimulus to the performance of ureteral implantation in suitable cases.

54 EAST SIXTY-SECOND STREET.

## AN INSTRUMENT TO OUTLINE THE PFANNENSTIEL INCISION

SYDNEY S. SCHOCHET, M.D., AND JULIUS E. LACKNER, M.D.,  
CHICAGO, ILL.

THE transverse or Pfannenstiel incision offers an excellent exposure for pelvic operations, lessens the occurrence of postoperative hernias, and obviates the ugly scar appearance so frequently seen after the low median incision.

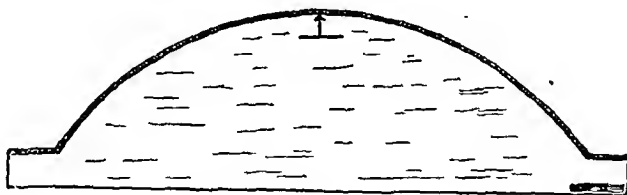


Fig. 1.

It appears to us that the reason there are not a large number of adherents to the Pfannenstiel incision in this country is due to the fact that it is frequently wrongly placed, and the curved transverse incision is not symmetrical with the result, that a poor exposure is obtained.

We have found that the apparent disadvantage of Pfannenstiel incision can be obviated if the skin is marked before the operation. For this purpose we have devised a metallic marker with a curve, whose radius is 12.5 cm. with an arrow to indicate the median line and a transverse mark to indicate that the curve is bisected.

The skin is marked with mercurochrome along this curve just within the line of pubic hair. The classical incision is then made along this marked curve.

55 EAST WASHINGTON STREET.



## A CASE IN WHICH SEVERAL FOREIGN BODIES WERE FOUND IN THE VAGINA OF A FEEBLE-MINDED PSEUDOHERMAPHRODITE\*

DR. R. A. LIVVENDAHL, CHICAGO, ILL.

The history available was very inadequate because of the noncooperative attitude of this feeble-minded colored patient. Her only reason for coming to the clinic of Dr. Emil Ries was the presence of a foul smelling discharge. No statement was volunteered by her that any objects had been introduced by her until the vaginal examination, and then with considerable difficulty. The only significant fact obtained was that she had never menstruated.

The patient was short statured, colored, twenty-three years of age, with slightly prominent eyes but no other evidences of hyperthyroidism. The hair of the body had the typical male distribution and the chin was the site of a moderate growth of thin black short hair. The breasts were flat and of a male type. The heart, lungs, and abdomen were free from any abnormalities. Her voice was of a female tone.

Vaginal examination revealed a normally developed vulva and introitus. The clitoris was 3 cm. long and up to 2 cm. in diameter, had a well developed glans, and prepuce of corresponding size. No pus was found in the urethra or labial glands. The vagina admitted the index finger with moderate ease and when the latter had been introduced to a depth of 5 cm., numerous small metallic bodies were palpated. By manipulation a hexagonal shaped nut 1 cm. in diameter was removed, with two round metallic beadlike structures like the buttons of a shoe. After this she became restless and refused further examination at this time.

One week later she returned and at this time four more shoe buttons, two rubber balls, and the cap of a tooth paste tube were easily taken out with a small gall bladder scoop. A small cork, with its broad end directed upwards was removed from granulation tissue in the posterior fornix. Now she stated that all these objects had been inserted over a period of eight months. She denied having had intercourse at any time.

Bimanual examination, after these foreign bodies had been removed, demonstrated a vagina of normal length but no cervix, body of uterus, or appendages could be identified.

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## REPORT OF A CASE OF VELAMENTOUS INSERTION OF THE CORD WITH RUPTURE, AND SUBSEQUENT DEATH OF FETUS IN UTERUS†

DR. HENRY B. BOLEY, BROOKLYN, N. Y.

S. K., white, aged twenty years, last menstrual period January 10, 1931, expected date of confinement, October 17, 1931. General physical examination negative, except for a systolic murmur at the apex. The uterus was in good position and enlarged to about a ten weeks' pregnancy. No bony abnormalities were noted. Blood pressure was 110/70. Urine was negative.

Her prenatal course was uneventful except for occasional mild headaches, some pyrosis and slight edema of the legs. Blood pressure varied between 110 and

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\*Described before meeting of the Chicago Gynecological Society, March 18, 1932.  
†Presented at meeting of the Brooklyn Gynecological Society, May 6, 1932.

118 systolic except on one occasion when it reached 130, but promptly returned to normal. Urine examinations were repeatedly negative. Patient experienced quickening on June 13.

On October 13 at 3:30 A.M., the patient began having labor pains, mild and occurring about every twenty minutes. At 4:30 A.M., there was a large gush of water followed immediately by profuse bleeding and many large clots. She was then admitted to the Jewish Hospital. At this time, she had only moderate vaginal bleeding and pains were slight and occurring every ten to fifteen minutes. Patient's pulse and temperature were normal. She had good color and the blood pressure was 140/90. The uterus was at full term, not tense, with fetus in R.O.A. position. The fetal heart could not be heard. The presenting part was floating and the cervix just admitted a tip of a finger. Voided urine specimen at this time was contaminated with blood. A catheterized specimen was negative. It was felt at this time that death of the fetus and the hemorrhage was due to a rupture of a velamentous vessel.

Pains ceased shortly after admission but a slight steady bleeding continued. Blood pressure at 2 P.M. was 150/100. On October 14 at 1 A.M., the pains started up again and from then on labor progressed normally and rapidly and resulted in a spontaneous delivery of a male stillborn at 9:50 A.M. The fetus weighed 6 pounds and the skull showed signs of beginning maceration. The placenta was then expressed complete with membranes. No abnormal bleeding followed. The patient had an uneventful postpartum course.

The placenta was 20 cm. in diameter. The cord was inserted into the membranes about three inches from the placental margin; from this point, the vessel diverged in the membranes to the margins of the placenta. There was a rupture of one of the vessels at a point midway in its course to the margin of the placenta.

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## REPORT OF A CASE OF YELLOW ATROPHY OF THE LIVER IN THE LATTER PART OF PREGNANCY, WITH RECOVERY\*

Drs. CAMERON DUNCAN AND GLEN R. MACLACHLAN, BROOKLYN, N. Y.

Mrs. N. B., colored, aged twenty-nine, was admitted to Kings County Hospital October 27, 1931. She had been seen one week previous in the prenatal clinic, and was advised then to enter the hospital at once for complete examination and observation because of previous cesarean section.

The past history was entirely negative. There were two previous pregnancies, one ten years before, terminating in a forceps delivery followed by six weeks' hospitalization, and one five years ago by cesarean section. The indications for both were not known. Menstruation normal, the last menstrual period February 12, 1931, the calculated date November 19, 1931. The pregnancy to date had been uneventful except for moderate nausea and vomiting during the first four months.

There was present a slight thyroid enlargement and the abdomen was enlarged to the size of an eight and a half months' pregnancy, with an upper midline scar from the previous cesarean section. Weight 155 pounds, height five feet, normal blood pressure and pelvic measurements. The laboratory data on admission, including urinalysis, blood count and blood chemistry, was normal.

On October 31, four days after admission, the patient was taken ill, first with chills, then nausea, vomiting, headache, a rise in temperature to 102° and pulse to 120. Physical examination negative except for moderate injection of the pharynx and a

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\*Presented at meeting of the Brooklyn Gynecological Society, May 6, 1932.

mild nasal catarrh. A diagnosis of grippe was made. The urine at this time showed 2-plus albumin; otherwise negative. Blood count: 4,096,000 red blood cells, 15,300 white blood cells, 80 per cent hemoglobin and 75 per cent polynuclear cells. A blood chemistry showed urea 35, creatinin 1.3, sugar 114. The following day the patient appeared acutely ill, had a fainting spell and the temperature reached 101°, with the pulse 128 and weak. At this time cardiac stimulation was commenced.

On November 2, slight jaundice appeared for the first time. She complained of severe headache and pain in the chest and back. She was still nauseated and not retaining food or fluids. At this time, tenderness below the right costal arch developed. A surgical consultation on this date was negative for gall bladder disease or appendicitis. For the first time, casts appeared in the urine, the albumin was increased but the blood count remained as on previous examination. The urine was negative for leucin and tyrosin crystals. The following day, November 3, the patient was still more deeply jaundiced, the severe headache, nausea and vomiting persisted, and she complained of generalized muscular aches and pains. A blood count on this date showed 3,500,000 red blood cells, 8,600 white blood cells, 75 per cent hemoglobin and 75 per cent polynuclear cells. The coagulation time was six minutes. The icteric index was 78 and the Vanderberg test showed a direct immediate positive reaction. The upper liver margin was at the third rib, and the lower border three fingers below the costal margin. Opinion, toxic hepatitis. The fetal heart had been heard and appeared normal up to this time, but disappeared November 4.

On the afternoon of November 5, the patient went into labor and had an easy, spontaneous delivery of a seven-pound macerated fetus. Nitrous oxide was given for five minutes. The next day, the patient was symptomatically improved. The increased liver dullness previously noted was lessened. The spleen was not palpable. The blood pressure was normal, as was the urine except for a faint trace of albumin. The blood chemistry showed urea 168, creatinin 2, sugar 145. Red blood cells 2,350,000; hemoglobin 25 per cent; white blood cells 30,000; polynuclears 66; lymphocytes 30; monocytes 3; eosinophils 1; degenerative index 89 per cent; microcytosis two-plus; macrocytes one-plus; anisocytosis three-plus; reticulated cells 2 per cent. On November 6, there was pronounced weakness and muscular pains. The jaundice remained but the liver was progressively getting smaller. A blood chemistry at this time showed urea 158, creatinin 3, sugar 133, icteric index 113, Vanderberg direct immediate positive reaction. On November 8, the patient was clear mentally in contrast to her previous persistently apathetic state but the intake of food still caused vomiting. The jaundice was definitely less and the blood chemistry practically the same as previously reported. On November 9, a 400 c.c. blood transfusion was given.

The condition gradually improved but a second transfusion of 500 c.c. was given. The urine report was still negative for leucin and tyrosin. A third transfusion of 500 c.c. was given on November 16. On this date, there were 2,500,000 red blood cells; 9,700 white blood cells, 65 per cent hemoglobin, and 73 per cent polynuclear cells. From this time on, the patient made rapid recovery, had no subjective complaints and on November 23 was allowed out of bed. On November 25, twenty-six days after the onset of the illness, she was discharged in good condition. Treatment had included cardiac stimulation intermittently as indications arose, and repeated clyses of saline, and infusions of glucose, saline, and calcium gluconate, as well as the three blood transfusions previously mentioned.

A blood culture taken during the period of acute illness was sterile. At the time of discharge from the hospital her blood count showed 4,000,000 red blood cells and 70 per cent hemoglobin and a normal urinalysis and blood chemistry. The diagnosis was "acute hepatitis with partial acute yellow atrophy."

## DISCUSSION

DR. SAMUEL A. WOLFE.—Cases of yellow atrophy of the liver are known to recover after pursuing a mild subacute course. Mallory of Boston has reported a series of this type, clinically simulating catarrhal jaundice. Regeneration and fibrosis occurs, and the liver ultimately assumes the gross characteristics of typical Laennec's cirrhosis.

In the case reported, the diagnosis of acute yellow atrophy requires further confirmation. The abrupt onset with chill and high temperature is rather atypical. The sudden hemolysis shown by a rapid drop in the number of the red blood corpuscles and in hemoglobin are indicative of a hemolytic anemia. The overloading of the circulation with hemoglobin derivatives easily account for the enlargement of the liver reported early in the disease. The blood chemistry in both hemolytic jaundice and acute yellow atrophy are somewhat similar. Retention of urea, uric acid, and creatinin, occurs in both.

The Van den Bergh reaction and the icteric index as reported appear in hemolytic jaundice. The high icteric index is indicative of obstruction of the biliary radicles due to overload of pigment. In the light of these facts the diagnosis of acute yellow atrophy does not appear completely substantiated.

DR. CAMERON DUNCAN.—The fact that leucin and tyrosin crystals were not found is not a constant factor in acute yellow atrophy, as Hunter, in an analysis of 23 cases found 9 that had neither leucin nor tyrosin, 10 cases with both leucin and tyrosin, 3 cases that had tyrosin alone, and one case with leucin alone.

Kottlors: The Treatment of Postoperative Urinary Retention. *Zentralbl. f. Gynäk.* 54: 2530, 1930.

Most of the commonly employed drugs such as urotropin, pilocarpin, calcium acetate, ammonium chloride, etc., do not have a direct influence on urinary retention, but derive their effect from psychic action. Obviously retention is due to one of two causes; muscle deficiency, or sphincter spasm. A postoperative patient is anxious to spare her abdominal muscle and, therefore, will not try to micturate. In this group, the personality of the physician is an important item. Sphincter spasm has been treated with antispasmodic drugs of the atropine group without much success. The writer claims that a rectal infusion of 50 c.c. of 2 per cent novocaine solution will be effective within one hour in the large majority of cases. Of 31 postoperative patients 84 per cent responded well to this therapy, urinating within an hour following the application. Even cases of urinary retention following radical Wertheim operation were favorably influenced.

WILLIAM F. MENGERT.

## Errata

On page 939 of the December issue the word Standard's in the twenty-first line from the bottom of the page should read Stander's.

On page 899 of the December issue, the second paragraph should read:

It is therefore evident that the theory of an increase of CO<sub>2</sub> as a cause of slowing of the fetal heart should be discarded (instead of discovered).

# Society Transactions

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## NEW YORK OBSTETRICAL SOCIETY

MEETING OF MARCH 8, 1932

The following papers were presented:

Epithelial Regeneration in the Uterine Glands and on the Surface of the Uterus. Dr. G. N. Papanicolaou. (See page 30.)

An Analysis of the Menstrual Changes in Tuberculous Women. Dr. E. M. Jamieson. (See page 22.)

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## BROOKLYN GYNECOLOGICAL SOCIETY

MEETING OF MAY 6, 1932

The following papers were presented:

Report of a Case of Velamentous Insertion of the Cord With Rupture, and Subsequent Death of Fetus in Uterus. Dr. H. B. Boley. (See page 156.)

Report of a Case of Yellow Atrophy of the Liver in the Latter Part of Pregnancy, With Recovery. Drs. C. Duncan and G. R. MacLachlan. (See page 157.)

Congenital Pneumonia of the Stillborn and the Newborn. Dr. J. Kaldor. (See page 113.)

The Complications of Radium Therapy in Gynecology. Dr. G. G. Ward. (See page 1.)

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## CHICAGO GYNECOLOGICAL SOCIETY

MEETING OF FEBRUARY 19, 1932

The following papers were presented:

The Technique of Radiation Therapy in Uterine Carcinomas. Dr. H. Schmitz. (See page 10.)

Internal Rotation of the Fetal Head, From the Viewpoint of Comparative Obstetrics. Dr. L. Rudolph and Dr. A. C. Ivy. (See page 74.)

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## CHICAGO GYNECOLOGICAL SOCIETY

MEETING OF MARCH 18, 1932

The following papers were presented:

A Case in Which Several Foreign Bodies Were Found in the Vagina of a Feeble-Minded Pseudohermaphrodite. Dr. R. A. Lifvendahl. (See page 156.)

Report of a Case of Ovarian Embryoma. Dr. P. J. Sarma. (See page 51.)

Some Urologic Complications in the Female. Dr. G. Kolischer. (See page 128.)

# Department of Reviews and Abstracts

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CONDUCTED BY HUGO EHRENFEST, M.D., ASSOCIATE EDITOR

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## Selected Abstracts

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### Endometrium

Hofbauer, J.: Concerning the Etiology of Hyperplasia of the Endometrium, Surg. Gynec. Obst. 52: 222, 1931.

The etiology of hyperplasia of the endometrium presents a problem which is still inadequately understood. Several writers have recently expressed the view that in all probability an unrecognized endocrine factor is concerned in the etiology of this condition, i. e., in view of the present knowledge of the nature of hormones in the blood and in the urine, great caution should be exercised in drawing conclusions from positive or negative findings in them.

Hyperplasia may reasonably be regarded as the manifestation of an overactivity of the anterior pituitary lobe. This conclusion, that an outside factor represents the primary cause of the disease, was reached when guinea pigs which were treated parenterally with derivatives of the anterior pituitary, produced conditions in the uterine mucosa, as well as in the ovaries, which were practically identical with those observed in endometrial hyperplasia in women. This obtained so long as the ovaries were preserved but when they had been removed, the process was limited to the basal portion of the endometrium. This conclusion is corroborated by the clinical experience that the condition commonly recurs after repeated curettage.

The question arises as to whether the anterior lobe of the pituitary registers its effect on the uterine mucosa directly or through the agency of the ovary. The author's observations indicate that the internal secretion of the ovary is essential for the changes occurring in the upper part of the uterine mucosa—"the functionalis," while the basal layer is under the control of the anterior pituitary lobe, as judged by the response of this structure to repeated pituitary administration in ovariectomized animals.

WM. C. HENSKE.

Burch, John C., Williams, W. L., and Cunningham, R. S.: The Etiology of Endometrial Hyperplasia, Surg. Gynec. Obst. 53: 338, 1931.

This is a careful histologic survey of numerous specimens of the human endometrium at various stages of the menstrual cycle. The findings from this material were compared with the histologic changes of the endometria of spayed mice which had been injected with extracts of estrin and corpus luteum and with a combination of the two. From these comparisons it was possible to gain an idea of the histologic manifestations which the various hormones produced.

Sections from 28 cases of Swiss cheese hyperplasia were studied in the light of these comparisons. Two typical cases of Swiss cheese hyperplasia from which both the uteri and ovaries were available for study were observed, in both a follicular cyst was present. Fluid from these cysts was injected into spayed mice and rats and the endometria from these animals were compared with that from the human uteri.

It was found that both estrin and the corpus luteum hormone produce a definite and characteristic reaction on the endometrium.

It is possible in cases in which mixed effects are obtained to determine by means of histologic study which of the hormones is predominant.

The histologic appearances of the endometrium obtained from cases of Swiss cheese hyperplasia are very similar to those found in animals which have been injected with extracts of placenta.

Material obtained from the follicle cysts of human cases of hyperplasia when injected into mice and rats, produced estrus. The changes in the uterus of each case were similar in many respects to those found in the uterus of the experimental animals receiving the fluid from that case.

WM. C. HENSKE.

**Adler, K.:** The Clinical Manifestations of Glandular Hyperplasia of the Endometrium, *Monatschr. f. Geburtsh. u. Gynäk.* 90: 340, 1932.

The etiology of granular hyperplasia of the endometrium is not clear. In most cases, there are enlarged ovaries with one or more follicle cysts and in the majority of cases, no corpus luteum is present. Adler studied 67 cases of endometrial hyperplasia from the clinical point of view. Most of the patients were more than thirty-six years of age (68.7 per cent). The next most frequent group was between fifteen and twenty-five years. The most prominent symptom was uterine bleeding and this varied considerably in type. In the majority of cases the bleeding consisted of an increased flow during the menses but the intervals between the periods were prolonged. In most cases the uterus was enlarged and this was observed in the very young patients as well as in the older ones. Almost all of the patients were nulliparas. The uterus was generally softened and the cervical canal offered no resistance to mechanical dilatation. During the preclimacteric period and the menopause, the enlarged uterus was usually associated with fibroids. The latter showed a special tendency to increased growth during the menopause. Zondek has shown that at the onset of the menopause there is an increased amount of folliculin in the blood and urine. It is therefore conceivable that the hyperplasia in the climacteric may be due to an excess of the proliferation hormone.

During the reproductive years there is a special tendency toward hyperplasia among nulliparas; for of the 17 women between fifteen and thirty-five years of age, 14 had never borne children. On the other hand, among the 45 women who had hyperplasia during the preclimacteric and the climacteric only 5 were nulliparas.

The treatment for women over forty years of age is simple. After curettage is performed and the diagnosis made, roentgen-ray therapy should be employed. In women past the menopause curettage alone usually suffices. In young women, a curettage is necessary for a diagnosis and it generally produces a temporary cure. However, the condition usually recurs. Hysterectomy is never necessary.

J. P. GREENHILL.

**Reinhart, H. L., and Moore, R. A.:** Tuberculous Endometritis, *J. Lab. & Clin. Med.* 14: 413, 1929.

The incidence of tuberculosis of the uterus is not as common as is often assumed. Primary tuberculosis of the female genital tract is extremely rare, in fact the exact modus operandi of infection has never been proved. Most tuberculous infections of the genital tract are secondary. Infection is usually transmitted through the blood stream (metastatic) and the original lesion is most frequently in the lung or bronchial lymph nodes. Metastatic lymphatic infection to the genitals is rare. The uterus being an organ which is constantly contracting, the lymph flow through that organ is so active that bacilli are not permitted to remain in one place long enough to develop a lesion. With menstruation the uterus performs a "physiologic curettage" by shedding itself. This physiologic function together with the menstrual congestion prevents chronic infection with ordinary bacteria, and this same factor is probably operative in the case of tuberculosis.

Reinhart and Moore state that the macroscopic appearance of tuberculous tubes and uteri in 75 per cent of cases cannot be distinguished from infectious lesions due to other organisms. Clinically, there is no pathognomonic symptom of tuberculous infection of the genital tract. The authors report two cases, worthy of note, the one with secondary tuberculosis of uterus and tubes, secondary probably to pulmonary tuberculosis, and the second a tuberculosis superimposed upon an atrophic fibrosis uteri. The authors conclude that there is a marked variation in the reported frequency of tuberculous lesions in the female genital tract; that the physiologic activities of various portions of the female genital tract may be responsible for variation in resistance to tuberculous infection and that tuberculosis of the uterus is more frequently superimposed upon a pathologic than a normal organ.

W. B. SERBIN.

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### Miscellaneous

Nakawaga, J.: Prolapse of the Uterus and Constitution. Japanese J. Obst. & Gynec. 14: 106, 1931.

At the Gynecological Institute of the Kyoto Imperial University prolapse of the uterus was observed during the last nine years in 1.18 per cent of all the patients and prolapse of both the uterus and vagina in 2.57 per cent. More cases were found in young women than is generally believed. Parity played a rôle in the following order of frequency: quadripara, primipara, tertipara, sextipara and quintipara. There was a relatively large number of prolapses among multiparas because the incidence among them was 4.55 per cent. An asthenic constitution was observed in 34.1 per cent of the cases, and tuberculosis was noted in 36.4 per cent. The author believes that prolapse of the uterus is caused by an abnormal constitution and that there is a close relationship between prolapse and tuberculosis. The latter leads to a deterioration of the constitution.

J. P. GREENHILL.

Wislocki and Snyder: On the Experimental Production of Superfetation. Bull. Johns Hopkins Hosp. 49: 103, 1931.

On June 12 a healthy, mature female rabbit was mated at 4:50 P.M. On June 16 at 12:15 P.M. this animal received 8 c.c. of anterior lobe extract intravenously. On the same day, at 4:30 P.M. they inseminated the animal artificially. On June 17, at 9:15 P.M., the animal was killed and autopsied.

The observation recorded demonstrated the possibility of successfully fertilizing a second set of ova. The living blastocysts had not prevented a second set of ova from becoming fertilized. Nor had the changes occurring supposedly in ovaries, tubes and uterus, after fertilization of the first set, prevented a second set of normal ova from being discharged and becoming fertilized. The present experiment fails to support the concept of the primacy of the ovum. The ova do not apparently exert an inhibitory influence upon ovulation, fertilization and maturation of a second set of ova.

This demonstration of the possibility of superfetation opens a number of avenues of investigation. It will be interesting to determine the fate of the second set of fertilized ova in the presence of the initial set of blastocysts. Will the period of transit through the tubes become altered? Will the spacing of the first set of ova or the reaction of the endometrium following their implantation prevent successful implantation of the second set? Does the time of implantation of the ovum depend upon the stage of development of the ovum or upon the condition of the endometrium? These and other questions can be answered by further similar experiments.

C. O. MALAND.



# Items

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## AMERICAN BOARD OF OBSTETRICS AND GYNECOLOGY

At the meeting of the American Association of Obstetricians, Gynecologists and Abdominal Surgeons held at French Lick Springs on September 12, 1932, a resolution was passed, taking note of the "increasing necessity for the determination and certification of specialists in the various branches of medicine," to the effect that in the future candidates for Fellowship in this Association who profess to be specialists in obstetrics and/or gynecology be required to be Diplomates of the American Board of Obstetrics and Gynecology. Official action of the Executive Council is necessary for any special exceptions to this regulation.

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At the recent meeting and examination of the American Board of Obstetrics and Gynecology held in Los Angeles, December 7th, the following applicants were approved for certification:

Max J. Abramson, Los Angeles, Calif.	Albert V. Pettit, San Francisco, Calif.
Theodore W. Adams, Portland, Oregon.	Henry M. Rooney, Los Angeles, Calif.
T. Floyd Bell, San Francisco, Calif.	Moses H. Ross, Los Angeles, Calif.
Warren Watson Bell, Seattle, Wash.	Charles S. Salisbury, Los Angeles, Calif.
R. Glenn Craig, San Francisco, Calif.	Henry N. Shaw, Los Angeles, Calif.
Roy E. Fallas, Los Angeles, Calif.	John W. Sherrick, Oakland, Calif.
Frederic Fluhmann, San Francisco, Calif.	Alson A. Shufelt, San Jose, Calif.
George B. Greenbaum, Los Angeles, Calif.	Gordon Graham Thompson, Seattle, Wash.
John Curtis Irwin, Los Angeles, Calif.	William B. Thompson, Los Angeles, Calif.
O. Donovan Johnson, Los Angeles, Calif.	Leon J. Tiber, Los Angeles, Calif.
Emil J. Krahulik, Los Angeles, Calif.	Albert M. Vollmer, San Francisco, Calif.
Fred Lindenberg, Los Angeles, Calif.	John Vrnwink, Los Angeles, Calif.
Frederic M. Loomis, Oakland, Calif.	
Clarence W. Page, Berkeley, Calif.	

Three additional candidates were conditioned and four candidates failed of certification.

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The next written examination and review of case histories will be held in cities throughout this country and Canada, where there are Diplomates who may be empowered to conduct the examination, on April 1, 1933.

The next general, clinical examination is to be held in Milwaukee on Tuesday, June 13, 1933, immediately preceding the annual session of the American Medical Association. Reduced railroad rates will apply.

Early application is requested from those desiring to qualify for these examinations. For further information and application blanks address Dr. Paul Titus, 1015 Highland Building, Pittsburgh, Pennsylvania.

# American Journal of Obstetrics and Gynecology

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VOL. XXV

ST. LOUIS, FEBRUARY, 1933

No. 2

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## Original Communications

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### THE QUALIFICATIONS OF THE SPECIALIST\*

PRESIDENT'S ADDRESS

WALTER T. DANNREUTHER, M.D., NEW YORK, N. Y.

A POLITICAL philosopher once made the epigrammatic comment that some men think that they have been called when they have not even been whispered to. One year ago, I was called to serve as your President without having been whispered to beforehand, and although anxious to avoid any bromidic remarks, I cannot refrain from expressing my gratitude to you for conferring upon me the greatest honor within your gift, and for affording me the opportunity to serve the American Association of Obstetricians, Gynecologists, and Abdominal Surgeons in a capacity I had never anticipated.

Since the preliminary plans which culminated in the creation of the American Board of Obstetrics and Gynecology were proposed and formulated within this Association, and the parent bodies are responsible not only for having endorsed and supported the project since its inception, but also in part for its proper functioning, it seemed that at this time I might with propriety discuss some of the details involved in the operation of the new organization you have fostered.

During recent years the medical profession has been afflicted with numberless irresponsible self-styled specialists. Their rapid multiplication has been due to several factors, not the least of which is that the public began asking who is a specialist before it thought to inquire what a specialist is. In view of the fact that the emoluments of an expert in one of the special fields of medicine are greater than those of a general practitioner,

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\*Read at the Forty-Fifth Annual Meeting of the American Association of Obstetricians, Gynecologists, and Abdominal Surgeons, French Lick Springs, Indiana, September 12, 13, and 14, 1932.

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NOTE: The Editor accepts no responsibility for the views and statements of authors as published in their "Original Communications."

that a license to practice imposes no restrictions upon its holder, that the reprehensible secret division of fees will insure a satisfactory financial return in many communities, and that the laity has had no criteria whereby it could distinguish those specialists who are well qualified from those who are not, it is not surprising that certain men without the necessary background of intensive training and wide experience have been tempted to misrepresent themselves. Asepsis, the skillful administration of anesthetics, and modern operating room technique have eliminated the hazards of pelvic and obstetric surgery to such an extent that the lure of the operating amphitheater is hard to resist. The pernicious tendency to teach senior medical students and hospital internes the refinements of major procedures at the expense of fundamentals is largely responsible for much of the unjustifiable and premature specialization. Entirely too many of the recent graduates gain the impression that gynecology and pelvic surgery are synonymous, and that the practice of obstetrics consists of either a professional reception of the baby, the application of forceps, or the performance of a cesarean section. They have not the proper conception of the art of adapting therapy to pelvic symptomatology, the importance of mature and correct obstetric judgment, the effects of particular operations upon the childbearing function, and the numerous factors that subsequently influence the patient's psychological stability and domestic happiness. As W. T. Smith said as long ago as 1858, "they have no methodized habits, no illustrative reminiscences to throw light upon the obscurities which may occur in their subsequent practice." They do not seem to realize that academic knowledge and the science of the laboratory can never entirely replace the wisdom of clinical experience. Imbued with such erroneous ideas, and with none to say them nay, they become specialists in obstetrics and gynecology by pronouncement. There are only two logical ways in which this state of affairs can be remedied: first by legislation, which is impracticable in this country, and secondly by the refusal of the profession and laity to tolerate the existence of pseudospecialists.

The term "specialist" implies that the individual so designated has had superior training and has assimilated knowledge from a multitude of opportunities, and the public is just beginning to display an interest in the qualifications he really possesses and to question his authority for so classifying himself. A specialist differs from a general practitioner in education, not in intelligence. As a matter of fact, the modern well trained doctor is essentially a specialist in internal medicine, pediatrics, minor surgery, and normal obstetrics. A hospital internship is requisite to practice medicine in but fourteen states, and only six specifically refer to the applicant's attendance upon confinement cases. Uniform standards for licensure must of necessity be secured by the enactment of legislative modifications in the medical practice acts of the different states. These are extremely difficult to accomplish and susceptible to political expediency. With such inconsistencies in the various laws pertaining to the practice of

medicine in general, the suggestion that specialism can be regulated by legislation is nothing more than a Utopian hope. But it is not unreasonable to expect that if the specialists themselves, with the sanction of the profession at large, certify to the proficiency of those who are competent, the public, both lay and medical, will be provided with a means for proper discrimination, and the State will be enabled to endorse such certification without alteration in its medical practice act.

The justification for the establishment of standards of qualification by the medical profession itself, to fix the requirements for legitimate specialization, thus appears to be self-evident, and it was with this objective in view that the American Association of Obstetricians, Gynecologists, and Abdominal Surgeons, the American Gynecological Society, and the Section of Obstetrics, Gynecology, and Abdominal Surgery of the American Medical Association assumed the obligation of creating the American Board of Obstetrics and Gynecology. By virtue of the harmonious participation and coordinated action of these three preeminent groups of obstetricians and gynecologists, the Board was endowed with an unassailable prestige. Its establishment was preceded by three years of preliminary study and careful planning on the part of the three committees charged with the task of evolving a satisfactory method of certification. The work was carried on so unobtrusively during the formative period of the committeemen's deliberations, that at the time of the Board's incorporation in September, 1930, a great many obstetricians and gynecologists were unaware of the manner in which it had been organized and its idealistic purposes. Not fully appreciating that each of the three National societies had elected three Fellows to comprise the membership of the Board, in some quarters its motives were viewed with suspicion, and its personnel mistaken for a self-appointed autocratic group who presumed to dictate to their colleagues. Voluminous correspondence, perseverance, and courteous explanations have been necessary to correct all sorts of misconceptions, a few of which still prevail. The activities of the Board have received the commendation and support of practically all of the distinguished obstetricians and gynecologists throughout the country, and the roster of its certificate holders now includes 369 names. Of these, 115 have been certified after examination. In June, 1931, the Board was notified "that the American College of Surgeons shall recognize the certificate of the American Board of Obstetrics and Gynecology as an evidence of the academic fitness in these specialties of candidates for its Fellowship who hold such certificates." Such sporadic instances of adverse criticism and hostility as yet exist are due chiefly to the rejection by the Board of all applications from those who do not limit their practice to obstetrics and gynecology, and to its refusal to certify without examination candidates who have no more than a local reputation, solely on the recommendation of their associates or friends. Many eligible obstetricians and gynecologists have apparently hesitated to apply for certification because of a not

unnatural anticipation of embarrassment during the course of examination. The most trying duty the members of the Board have had to perform has been to resist the importunities of those who are probably well qualified, but whose competency for special practice is unknown outside of their respective communities. It should be obvious that personal endorsements as testimony of fitness might soon lead to dangerous injustice and a lowering of standards. The slightest exercise of favoritism, influence, and even prejudice would jeopardize the value of every certificate issued. All applications have been referred to a Committee on Credentials which is charged with the responsibility of classifying candidates. Each diplomate of the Board who was certified without examination received the unanimous vote of all nine examiners, and subscribed to a statement that he restricted his practice to obstetrics or gynecology; and with comparatively few exceptions, each one was either a Fellow of this Association or the American Gynecological Society or held a professorial rank in one of the medical schools. Certification without examination was discontinued on December 31, 1931.

The Board has arranged that no examiner shall participate in the survey of any applicant from his own territorial district nor of one with whom he is personally acquainted. This provision precludes violation of the candidate's professional pride and an insinuation that his attainments are in any way disrespected. The object of conducting an examination is to discover the extent of the applicant's knowledge, the character of his practices, and his cultural and scientific attributes. Personal evaluation must always supplement standardized requirements.

The chief purposes of the Board are not restrictive, but educational: to encourage and induce potential specialists in obstetrics and gynecology to prepare themselves thoroughly, to persuade medical schools and hospitals to provide adequate facilities for special training, and to put the stamp of approval on qualified specialists. There is no inclination to curtail the professional responsibilities that any licensed physician may care to assume, nor an implication that a distinguished or well qualified specialist requires a further testimonial of his capabilities. Neither has the Board the desire nor power to control or govern the practice of obstetrics and gynecology, and applications for certification must always be voluntary.

Thirty years ago the novitiates in medicine had the benefit of the wise counsel and supervision of their preceptors, a custom which might well be revived. The highest professional ideals, a broad humanity, intellectual honesty, and an incorruptible conscience were inculcated in the younger men by their seniors. There were but meager institutional opportunities for the training of specialists, and that a young man should presume to pose as a specialist until he had carried on a general practice for at least five to ten years, studied incessantly, and served a prolonged apprenticeship to a recognized authority was unthinkable. That conditions have changed materially is well exemplified by the recent statement that it is

now relatively easier to be a specialist than it is to be an up-to-date, well trained general practitioner. Few modern neophytes study actively the various branches of medicine after graduation, or seem to be concerned with the importance of a firm foundation in general medicine as a basis for specialistic ambitions. In a timely address on "Specialism" in 1892, Osler said, "no more dangerous members of our profession exist than those born into it, so to speak, as specialists." That aphorism is as pertinent to-day as it was forty years ago. It is not at all unusual at the present time to witness the ex-house officer within six months after completion of his internship alternating with his former attending surgeons in the operating rooms. He appears seriously interested in curettage, appendectomy, and hysterectomy, but he has yet to learn that the curette will not cure leucorrhea, that pain in the right lower quadrant is usually due to something other than the appendix, and that while removing the uterus may be the easiest it is not always the best way to arrest uterine bleeding. The members of the American Board of Obstetrics and Gynecology believe that while the young man under proper guidance may practice obstetrics and gynecology safely, he is not entitled to announce himself as a specialist until the lapse of at least five years after his internship, and the devotion of three of the five years to intensive training in obstetrics and gynecology. This special training need not necessarily be full time institutional work, but it must otherwise embrace a satisfactory apprenticeship or postgraduate education, with concurrent clinical experience under supervision. The candidate must demonstrate his proficiency in the diagnosis and non-operative treatment of pelvic disorders, and exhibit good obstetric and surgical judgment.

It is almost incredible that with the available laboratory facilities, clinical pathology should be ignored by those who have the greatest opportunity to profit by it and correlate it with their daily work. In this respect the examinations already held by the Board have revealed an astonishing indifference to a knowledge of the pathology of common obstetric abnormalities and pelvic diseases and neoplasms. It does not seem unduly exacting to expect one who professes to be expert in operative procedures to be familiar with the intrinsic pathologic alterations in the tissues involved, but it has been apparent that comparatively few obstetricians and gynecologists have sufficient scientific interest to follow their specimens to the laboratory. Ample evidence is at hand, however, to indicate that many of the younger men have been stimulated to read and study so that they might be prepared to pass the examination for certification. And those who have failed once in the examinations already held have endeavored to correct their deficiencies or have indicated their intention of augmenting their qualifications before presenting themselves for reexamination. These immediate effects of the work of the Board have been very gratifying.

Letters of inquiry have been addressed to the Board repeatedly, asking

where the writers might secure the advanced work requisite for specialization, but in most cases it has been impossible to direct the applicant with an assurance of the fulfillment of his aspirations. The comprehensive report emanating from the Medical Service Subcommittee on the Graduate Education of Physicians for the White House Conference on Child Health and Protection, in 1930, was based on an accurate and inclusive inventory. It disclosed that although the institutional facilities for the development of specialists in obstetrics and gynecology have been amplified materially since the beginning of the century, they are still inadequate in both number and scope. Complete unification of obstetrics and gynecology has not been accomplished in the majority of medical schools and hospitals. In fact, in a number of the latter it is distressing to note that gynecology has not been divorced from the department of general surgery. The departmental integration and fusion of obstetrics and gynecology is not only desirable but highly essential, because the skillful practice of one is dependent upon a thorough knowledge of the other. Skill comes not only from a maximum of cases, but also from the absorption of information derived from sound precept and observation. It must be conceded that the large *Frauenkliniken* abroad are far better equipped to produce specialists than our own institutions, although the available clinical material is no greater. The White House Conference Committee report stated that "there is a total of 1045 obstetric-gynecologic teachers in our medical schools. We may conclude that nearly 1000 of them have been self-trained." The following additional excerpts from the Committee's conclusions are significant:

"The obstetrician who does not do the surgery of the lower abdomen is hardly competent to do the major abdominal work of obstetrics.

"The gynecologist who is not in intimate contact with all phases of obstetrics has lost much of his perspective in operating on women of the childbearing period.

"There were 1045 teachers of obstetrics and gynecology in the United States last year (1930). The vast majority of these developed themselves after a more or less insufficient under-graduate training.

"Nine graduate schools turned out about 100 trained men: these men worked for years as subordinates, supervised, and then as their competency was recognized they were given full recognition as clinicians.

"The great majority of men posing as obstetric specialists have had very little training: their experience has been gained by practice—and practice does not always make perfect.

"One large city carries in its medical directory the names of 411 obstetric and 440 gynecologic specialists. The term 'specialist' is well nigh meaningless in this country. A new order of being demands that no man may pose as a specialist until he has proven his ability to so function."

The Board has appointed a Committee on Graduate Education, which will undertake to devise ways and means to rectify some of these defects in our educational system.

The public has a right to expect the medical profession to safeguard it from the malpractices of mushroom specialists, and five of the specialistic

groups, of which we are one, have manifested their disposition to accept their share of responsibility, by creating examining boards under the auspices of the National societies. The endeavors of these Boards are not offered as a corrective panacea for all the defects of professional practice, but they can at least wield a salutary influence, especially if they receive the active cooperation of their diplomates. The establishment of desirable standards for specialists minus an impartial and widespread application of them would be merely intellectual exercise. The certificates of the American Board of Obstetrics and Gynecology can be a protection to local obstetric and gynecologic societies as well as to hospitals. Several of the ophthalmic and otolaryngologic medical societies have made the possession of either of these certificates essential for membership, and it would be to the advantage of the obstetric and gynecologic organizations to emulate their example. One sectional society has already adopted the Board's standards of qualification as a prerequisite for eligibility.

Whereas in the beginning the motives of the American Board of Obstetrics and Gynecology were regarded with considerable skepticism by many of our professional brethren, during the past two years the project has gained tremendous momentum, and its successful functioning has now attracted the attention of other educational groups. A willingness to exercise a paternalistic supervision over the activities of the Board has already been intimated. In my opinion, nothing can be gained by permitting it to become subservient to extraneous influences, whatever their purposes may be. It is not inconceivable that informal contact might develop into domination, and finally eventuate in absolute control. The authority and powers of the American Board of Obstetrics and Gynecology are derived from the parent National societies, and it is to these, and only to these, that the Board should be answerable.

It is a tremendous responsibility for anyone even to insinuate that the technical practices of another are wrong. The examiners have done the best they could at all times, regardless of censure or applause. Nothing but the merit of its objectives and its successful accomplishments can perpetuate and insure the future existence of the American Board of Obstetrics and Gynecology, and in these I have full confidence.

580 PARK AVENUE.



## SOME PHASES OF THE TOXEMIAS OF PREGNANCY\*†

BETHEL SOLOMONS, M.D., F.R.C.P.I., F.C.O.G., DUBLIN

(*Master of the Rotunda Hospital*)

THE Rotunda Hospital of Dublin has existed for nearly two hundred years. Its bicentenary will be in 1945 and during this period every effort has been made to keep up to date, to try out the new without forgetting the old, to remember above all, that obstetrics is a difficult subject, that it is a science and an art, and not a trade, and that every effort must be made, not only to preserve the life of the mother and the child, but to discharge the mother from hospital healthy and happy without being marked for life with the traumatism of labor.

In addition, as is well known, students, postgraduates and nurses from all parts of the world are trained at the Rotunda. This system has great advantages: in their future professional life they will work together and it is well they should be brought up together. The segregation of nurses and doctors in maternity training has never appealed to me and I hope that the custom which has been so long in vogue in Dublin will long continue. The presence of these three bodies of pupils should make the teacher meticulous in his technique. He must never indulge in any small departure from detail for there are no more severe critics of any digression than the average student, postgraduate, or midwife and there is none more ready to adopt such digression as a practice. In other words, the child in obstetrics must be taught good manners as the child in life is taught in the nursery and example is the best method of teaching.

The causes of the toxemias of pregnancy are unknown: the number suggested and proved to be causal factors emphasizes this fact. I cannot give a full consideration to this discussion within the limits of this communication: most of the theories will be mentioned in order to be discarded and the only two which can "hold water" at all will be discussed. These two theories must be taken together: they are the only two which can be proved by clinical results to a large extent and by laboratory results to some extent. They are the theories of Young and that suggested by Tweedy and held and elaborated at the Rotunda Hospital. We have been quoted in the past as stating that "the cause of eclampsia is in the gut," and that "food causes eclampsia." Both these bald facts are incorrect and I desire to refer to the book on *Practical Obstetrics*, which now bears my name.<sup>3</sup> "We know full well that food is one of the

\*The Joseph Price Foundation Lecture, presented by invitation, before The American Association of Obstetricians, Gynecologists and Abdominal Surgeons, at French Lick Springs, Indiana, September 12, 1932.

†For lack of space this paper is published in an abbreviated form, but the complete article will appear in the author's reprints as well as in the current volume of the Association's Transactions.

common factors, but we are in entire agreement with Young and others who state that the disease is of toxic origin, that this toxin is almost certainly derived from the placenta, either from the chorionic villi or from placental infarcts or from the blood. The fact remains that the exact toxin has never been found, but it probably circulates in the blood of the patient. The destructive changes found throughout the body are due to the action of this toxin. This does not explain the whole cause as it does not explain why toxemia occurs in some patients and not in others. Food is the cause, but not directly as will be shown later. It is well known that all foreign proteins must be changed by the ferments of the body before they can be assimilated: if they are absorbed without undergoing such change they act as irritant poisons. The poison of eclampsia, for example, may be explained in this way, on entering the body this toxalbumin must be neutralized by the ferments already present if its destructive effect is to be avoided. Is it not reasonable to conclude that the ferments which effect this neutralization are those which fix the amino-acids derived from food?"

\* \* \* \* \*

Our view may be summed up by the following simple table:

Food poisons plus toxins of pregnancy	Excess of food poisons. Amino-acids plus toxins of pregnancy
Enough ferment for both	Insufficient ferment for both, i. e. ferment used up for pregnancy toxins
No toxemia	Insufficient neutralization
	Toxemia

\* \* \* \* \*

Of all the tests in diagnosis of toxemia, there is none more simple than the Fouchet test. It is easily done and the results can be reported very shortly; it is also reliable in the diagnosis of liver involvement. In a former communication<sup>4</sup> Bourke and the writer showed it to be most valuable in hyperemesis gravidarum without albuminuria, but that in eclampsia and eclampsism, it was chiefly negative. That is, of course, the expected result.

We cannot agree with Cruickshank<sup>5</sup> et al., who state that the results of tests of hepatic function are of no real service. Enough has been said to show our feelings about the intestinal indirect origin. Suggestions have been made that intestinal hyperpermeability leading to absorption of toxic intermediate products of digestion, e. g. peptones, or bacterial metabolism may be the definite cause. Acidosis due to double metabolism is a simple thing to claim but brings us no further and those who speak of alimentary autointoxication may reiterate, in a different way, our own sentiments.

A theory to support our view is that of Alvarez<sup>6</sup> who, in his impartial review, summarizes the evidence for toxemia of autogenous origin and dis-

cusses the importance of the alimentary tract. He, however, concludes that the mechanical factor is specially important in causing vascular engorgement of the intestinal wall, stasis and abnormal permeability.

As the mechanical factor has been mentioned, Paramore<sup>7</sup> must be quoted. Intraabdominal pressure is his catchword and this, he says, is fundamentally related to general metabolism. The greater the intraabdominal pressure, the greater the return of blood to the heart. Paramore's conception that eclampsia is simply a manifestation of a gradually perverted metabolism due to an excessive compression preventing visceral activity, is supported by the fact that the levator ani muscles hypertrophy in pregnancy, that eclampsia occurs in the strongest women with good abdominal walls. Can it be believed, says Paramore, that any specific toxin is in play? We fear that he has unwittingly evaded the issue.

Then Theobald<sup>8</sup> shows by experiments that albuminuria associated with pregnancy can be accounted for by mechanical means, e. g., lordosis, diminished thoracic capacity of later months of pregnancy, and the weight of the uterus. Possibly the damage to the kidney in eclampsia is the same as that caused by increasing the pressure in the renal vein.

My late assistant, O'Donel Browne,<sup>9</sup> following the example of my chief, Tweedy, tries to show the relation between blood extravasation and albumin and applies this to theorize on accidental hemorrhage. It is an interesting theory, but there are too many albuminurias without extravasation of blood, and too many cases of blood extravasation without albuminuria, to permit its acceptance. It may, however, lead to something.

Titus<sup>10</sup> has stated that "there is a disturbance in carbohydrate metabolism, but hyperglycemia is not characteristic of eclampsia. As convulsions in eclampsia are to be designated as a hypoglycemic reaction or manifestation, insulin with or without glucose is unnecessary and contraindicated. Intravenous injection of hypertonic glucose solution has a definite basis for its proved therapeutic value." I have the greatest respect for Titus, but this does not explain the whole case for treatment of the toxemias, nor is it, I am sure, intended to do so.

James Young,<sup>11</sup> who reiterates the statement that there is some factor in eclampsia which causes placental damage must be listened to. He proves his point to a large extent, and his theory, taken in conjunction with ours, bears close investigation. It is only necessary to read the works of Cruickshank and Stander<sup>12</sup> to realize how difficult it is to theorize on this subject. In summing up the question of theories, Cruickshank concludes that if the toxemias of pregnancy have a common cause, it is some form of intoxication from the breakdown of placental tissue, probably some of the higher forms of protein catabolism which, like the breakdown products of lecithin, have a powerful action even when present in a small amount.

The theories of etiology of eclampsia as collected by Stander are:

autointoxication, fetal elements, fetal metabolic products, placenta, infection theory, endocrines, biological reaction, mammary, diet, renal origin, edema theory, capillary spasm, oxygen deficiency, nervous origin, liver, nitrogenous retention, inorganic constituents of the blood, lipoids, colloids, carbohydrates, acidosis, and hypertension.

A close study of this extended list has unfortunately compelled us to refuse acceptance of any one of them. If theories are to be of any real value they must assist in determining suitable clinical treatment. When followed out to the bitter end, it has been found that there has been no useful treatment derived from any of these. Our own treatment has a direct relation to our theory of the cause.

#### VARIETIES OF TOXEMIAS

The nomenclature regarding toxemia of pregnancy seemed on investigation to be so inconclusive that a questionnaire was sent to various institutions and the answers obtained from them will be summed up later. To the Registrars of the Institutions and the Chiefs of the Clinics my thanks are tendered for their kindness in replying. Unanimity was observed about certain diseases. All included eclampsia, eclampsism, hyperemesis and acute yellow atrophy. Two omitted accidental hemorrhage altogether. Essen Möller modified the kidney cases by including albuminuria, with not more than 10 per cent albumin and nephritis, with more than 10 per cent albumin. Herpes, salivation, chorea, and melancholia were included in the lists of some of the others. This list could be added to enormously but from a practical point of view an increase clouds the issue and leads to no beneficial result. It is noteworthy that accidental hemorrhage is not included in the works of Stander or of Cruickshank and his colleagues.

I desire to discuss briefly: Albuminuria without marked toxemic signs and symptoms, eclampsism, eclampsia, hyperemesis gravidarum, and accidental hemorrhage.

\* \* \* \* \*

#### ALBUMINURIA, ECLAMPSISM, ECLAMPSIA

Such is the simple classification I use of the toxemias whose chief and cardinal system is albuminuria, because it is simple, it expresses a definite thing, and other classifications in my opinion confuse the issue, instead of clarifying it.\*

\* \* \* \* \*

*Albuminuria.*—This refers to a condition in which the patient is admitted to the labor ward, simply because of albumin in the urine. She is supremely important because if she is not carefully watched she may develop eclampsism, eclampsia, or some other type of toxemia. In this

\*Since writing this Young (J. Obst. Gynec. Brit. Emp., 39: 2, 310) has suggested "Preeclampsia and Eclampsia" as the best classification and this practically coincides with ours.

type there are no other symptoms, the blood pressure is often not raised, the output of urine is not decreased, there is no marked edema. The blood urea is normal and other biochemical tests are usually negative. In spite of all this, the patient must be carefully treated and again, simplicity is the keynote. We classify albuminuria as follows: trace, present, abundant, or solid. The first warns us of danger, the second that danger is present, "abundant" suggests eclampsia, and solid that eclampsia is nearly always present.

I have tried all laboratory tests with a view to determining treatment, but reliance is placed almost entirely on the clinical manifestation. Water is given to the amount of four or five pints daily, flavored with lemon juice, also glucose. Glucose is given by the bowel. Purgatives are given at least once daily and enemas, if necessary. If the condition has not cleared up in three days induction is done. We used to leave these patients four days but a condition of hypoglycemia may arise if starvation is continued too long.

*Eclampsia.*—It is questionable whether a term which suggests "similar to eclampsia" is better than a term which suggests "before eclampsia." We prefer the former. Eclampsia is eclampsia without fits. All the symptoms and signs of the latter are present and the postmortem findings are the same. We treat our cases in the same way as we treat eclampsia except that morphine is not administered unless the patient is very restless, also induction by means of puncture of the membranes is done after three days' treatment without improvement. It must be stressed that it is far better to pursue treatment before induction rather than induce at the peak of the illness. It is well known that the kidney condition does not improve in labor, so that a diminution in the amount of albumin, a lowering of the blood pressure, and an increase in the amount of urinary secretion are all desirable before induction.

If the amount of albumin is great, if the secretion of the urine is small, if the blood pressure is between 180 and 200 systolic, while the blood urea is 100 mg. per cent, induction will surely be necessary. If the symptoms of eclampsia occur in the early months the case is nearly always prepregnancy nephritis. Termination of the pregnancy is nearly always indicated in this class of case and a vaginal or abdominal section is usually the treatment in the presence of a chronic nephritis.

*Eclampsia.*—In a recent communication<sup>15</sup> the writer, with Bourke, stressed particularly the nomenclature of eclampsia. Questions submitted to various maternity hospitals elicited the fact that "fits were necessary in nomenclature." In this paper several cases were described showing difficulty. One was a para iii who had had two normal confinements. She was admitted in convulsions and with blood pressure 122/70. She had routine treatment and was delivered spontaneously of a stillborn fetus weighing  $4\frac{3}{4}$  pounds. There were signs of consciousness returning and she seemed to be improving. Later coma returned. Blood pressure 142/70. Blood urea 30 mg. per cent. She then proceeded to have 31

convulsions and died. The postmortem report was atypical for eclampsia and exemplifies not only the danger of fits in the multipara but also the difficulty of determining whether a patient has eclampsia or not.

We then proceeded to give the postmortem results side by side with those found in typical eclampsia. The case quoted was not an eclamptic. She had, however, fits and toxemia, therefore she must be included in eclampsia statistics. We define eclampsia as the occurrence of fits in a pregnant or puerperal woman which would not have occurred if she had not been pregnant.

Williams does not go so far and defines eclampsia as an acute toxemia occurring in the pregnant, parturient or puerperal woman, usually accompanied by clonic and tonic convulsions. He states that while the convulsions are by far the most startling clinical manifestations of eclampsia and give the disease its name, instances are occasionally met with in which they are absent. Greenhill,<sup>15</sup> in 1926, in his definition mentions convulsions, but includes also those cases of acute toxemia without convulsions, which at necropsy show the changes characteristic of eclampsia. Greenhill's definition bears out the difference in opinion on this subject. A perusal of his 78 cases, however, shows that convulsions were present in all.

We cannot find a definition of eclampsia in the monograph by Stroganoff.<sup>17</sup> We fear, until it is otherwise ordained at an International Congress, that we must include in our statistics of eclampsia (until it is proved otherwise) these pregnant or puerperal women who die having had fits, unless the postmortem results reveal absolutely atypical lesions. If the patient does not die, she too, for the present, must be included, and if she does and a necropsy is impossible, then she also is grouped as eclampsia.

Notes of questionable cases could be multiplied many times.

Since writing this, Stander,<sup>16</sup> Ashton and Cadden<sup>18</sup> state that in one-tenth of their cases diagnosis is difficult. They recommend urea and creatinine excretion tests for routine use in all cases of toxemia of pregnancy where the diagnosis is not clear. A urea clearance of below 80 per cent of the normal and a creatinine excretion below 155 mg. in the first hour, are strongly indicative of renal damage. Does the word "indicative" mean certain?

Eclampsia may occur from the sixth lunar month until forty-eight hours after delivery although cases have been reported some days after this. It is a grave disease at any time. It is most serious in the puerperium of the multiparous patient. In our last investigation of 204 deaths, the death rate was 8 per cent. In the first five years of the present Mastership the death rate was 12.9 per cent. If the true eclampsia cases are taken with these the mortality rate becomes 6 per cent.

*Symptoms and Signs.*—In a communication of this kind these will not be dealt with minutely. The warning signs and symptoms must be treated. These are headache, vertigo, partial or total blindness, pruritus,

drowsiness, mental irritability, insomnia, edema, diminished secretion of urine, raised blood pressure. A very itchy nose often precedes a fit.

As eye symptoms have been mentioned, it will be of interest to refer to a small investigation of the eye symptoms made at my instigation at the Rotunda by our consulting ophthalmologist, Mr. F. Crawley and his assistant, Dr. L. Werner. In this investigation 250 cases were examined of which 186 were normal, and 64 were in toxemic women. Of the former 186 the eyes were normal in 179 and abnormal in 7.

\* \* \* \* \*

Does it seem as if the retinitis-producing toxin is of bad obstetric import, and have the cases with retinitis done worse than these with albumin, but retinitis free?

The only other sign which must be mentioned is elevated blood pressure. This is considered to be a most valuable sign by F. J. Browne.<sup>19</sup> There is no doubt that the recognition and treatment of warning symptoms and signs followed by appropriate treatment will allow us to ward off an attack. It is not proposed to describe the eclamptic fit nor to delve into differential diagnosis. The treatment will be considered in detail and it must be remembered that every detail must be attended to, and that eclampsia is treated in the same way as eclampsia, except in so far as the fit is concerned.

#### TREATMENT OF ECLAMPSIA AS CARRIED OUT AT THE ROTUNDA HOSPITAL

The treatment at the Rotunda has stood the test of time and seems theoretically and practically sound. It is not intended to discuss other treatments in detail but some must be mentioned: cesarean section, abdominal or vaginal. This treatment is the favorite of the gynecologist who is practicing midwifery in contradistinction to the obstetrician who is practicing the science and art of obstetrics, and this question is truly very important if maternal mortality is to be lowered. Some gynecologists seem rather to revel in the fact that they only do consulting midwifery: these men cannot know the subject. At some Utopian time there will be a law that only practicing obstetricians may be called into consultation on obstetric problems, then cesarean section at sight for nearly every complication will be a thing of the past.

The results of the discussion at the British Obstetrical Congress in 1923 showed clearly that palliative measures were best, and since that meeting, nonradical measures have been popular in Great Britain and Ireland. Certainly cesarean section in Ireland met with disaster in the treatment of eclampsia. In Greenhill's interesting paper he says that the treatment should not be entirely conservative nor entirely radical, but favors emptying of the uterus in experienced hands. In spite of this a study of his mortality figures shows spontaneous deliveries with 3.4 per cent deaths, cesarean section 6.7 per cent, forceps 9.5 per cent, version and extraction 14.3 per cent.

Apart from radical measures, drugs to bring down the blood pressure were popular for a time: this is an incorrect line of treatment for a gradual fall in the blood pressure is valuable, a sudden fall sometimes means fatality.

Other treatments such as kidney decapsulation, magnesium sulphate, etc., are only small points included in large technics. Once we belong to what may be called the palliative school, we must be Rotunda or Stroganoff and in spite of figures the treatment carried out in Dublin seems more rational. Great respect must be accorded to Stroganoff for his work, but it is difficult, bearing in mind the work done by Bollman<sup>20</sup> on the effect of chloroform on the liver, work showing that chloroform had exactly the same effect on the liver as the toxemias, to accustom oneself to give chloroform to the eclamptic with the very depressed heart! No more will be said, but at the risk of repetition our treatment will be given in full detail.

The only changes I have made are the administration of glucose either by the mouth or bowel or under the breasts and rarely intravenously: also venesection. Although brought up on the dangers of this last procedure, I have been converted to it as a valuable aid in treatment. Eight ounces of blood are withdrawn if the blood pressure is over 160 mm. Hg systolic and this is repeated daily if necessary. Since adopting this form of treatment the incidence of cerebral hemorrhage has been lowered.

#### SUPPLEMENTARY MEASURES

*Nursing.*—This is at least 50 per cent of the treatment. The nurse must be given directions especially when the patient has a fit. In addition, we have volunteers from among the postgraduates, to look after the patient. Everything must be ready, the gag, the bullet forceps to catch the tongue, the mucus extractor, the spoon with handle bound, or the toothbrush to slip in between the teeth. During a fit mucus pours from the mouth like water from a tap, and during a fit the patient must be brought over with her face to the ground, the tongue brought forward, and the mucus removed or she will surely die. She is placed in a quiet room, *not dark*, and morphine is given. She lies on the side. If she is conscious a purge such as the mist seminae co. of the British Pharmacopoeia is given, colon lavage, gastric lavage, submammary infusion.

*Morphine.*—This is a beneficial drug: it controls the fits and the fewer the fits, the better the prognosis. Morphine raises the  $\text{Co}_2$  combining power of the blood and this is of value. Its disadvantage is its effect on respiration. The rate may go down to 4 or 6 per minute, but atropin and oxygen are used to combat this.

Our routine consists of half a grain with the first fit, and a quarter of a grain with each fit up to two grains in the twenty-four hours, but two hours must elapse between each dose, that is, if the first dose is at six, the next not to be before eight, the next ten, and so on.

*Colon Lavage.*—Colon lavage is repeated when necessary, that is if the bowels do not move satisfactorily in six hours. Occasionally it may be repeated again but a third lavage is scarcely ever necessary. The bowels should move four or five times daily. Also if urine is not being secreted, repeat the lavage, as the toxemic condition is preventing the kidneys from functioning. Linseed poultices are applied to the loins at two-hourly intervals to favor urinary secretion.

*Gastric Lavage.*—This is done when vomiting is a marked symptom or when the patient is so unconscious that the only means of giving a purgative is by the tube.



Gastric lavage increases shock so that it is only carried out when urgent symptoms demand it. A purgative such as 3 ounces of mist sennae co. is left in the stomach.

*Submammary Infusion.*—If the patient is not improving, if the pulse is weak and thready, and if there is insufficient secretion of urine, sodium bicarbonate solution, one drachm to the pint, is infused under each breast. This is an important part of the treatment. The temperature of the fluid should be between 110° and 115° F., and the strictest aseptic precaution should be taken, otherwise extensive infection and sloughing of the parts may follow. It should be repeated if the symptoms do not improve. No matter what theoretical objections are advanced to the administration of fluids under the breasts, we still persist and believe in it as a valuable adjunct in treatment.

*Treatment with regard to birth:* Forceps are applied when the head is in the lower strait and all conditions are fulfilled. Ether is the anesthetic chosen. Chloroform is a heart depressant and must be avoided.

*Other points:* If a woman with eclampsia recovers and the baby is not delivered, she often goes to full term. If, however, there is the slightest sign of recurrence, labor is induced. A woman who has had eclampsia is liable to recurrence, and she should not be allowed to become pregnant until she has been albumin free for six months. Even then, she must be carefully watched in pregnancy. Our results will be given at the end of this paper.

*Hyperemesis Gravidarum.*—In collecting information from other institutions, it was easy to see that the name hyperemesis was often misunderstood. In this communication the name implies excessive vomiting accompanied by marked constitutional symptoms and definite signs of toxemia. The true toxemic condition is now easily diagnosed from the so-called reflex neurotic. We do not believe in reflex, and the neurotic can be cured without difficulty after ruling the toxemic condition out. Theories other than those mentioned at the beginning of the communication will not be discussed. Probably the acidosis which is present is very vital but it does not tell us how it occurred. If a patient who has recovered from hyperemesis is given the smallest amount of food too soon, there will be a recurrence, with in all likelihood a fatal issue.

The cases at the Rotunda are dealt with as follows: If albumin is present in the urine, kidney function tests are done, but these are unnecessary if the clinical symptoms which accompany the albumin are very marked. If there is no albuminuria, the Fouchet test is done: if it is positive the case is one of toxemia; if not, and there is no albumin, the case is neurotic. There is an exception to this, the possibility of such nonpregnancy conditions as gastric ulcer, cholecystitis, appendicitis, and pyelitis. Once the diagnosis has been made, treatment must be active, and in this connection it is of interest to read the treatments adopted at some of the maternity hospitals from whom enquiries were made.

*Queen Charlotte's:* Termination when truly toxic.

*Essen Möller at Lund:* Two days without food, not even water. Rectal injections of fluid, in more severe cases insulin. No abortion induced for thirty years. (He does not say if there has been any abnormality.)

*Sheffield:* Severe cases are rare. Emptying the uterus, rectal glucose and graduated diet.

*Manchester:* 127 cases, 98 cured, 27 evacuated, 4 deaths.

*New York Lying-In:* Intravenous glucose, normal saline, corpus luteum, carbohydrates.

*Coombe*: Purgative, forced fluids, glucose in isotonic strength. Gastric lavage. Lugol solution Miii, t. i. d. p. c.

*Bristol*: Calcium. Glucose. Vitamin D. Evacuation.

*Cardiff*: Isolation from relatives, full feeding, attention to bowels.

It will be seen by these notes that the treatment is varied. In five years at the Rotunda, there were only 24 cases which could be called true hyperemesis. There were three deaths, a mortality rate of 12.5 per cent.

The treatment adopted is (1) gastric lavage with purgatives left in stomach, (2) glucose by mouth if possible, otherwise by rectum, under breasts, and in severe cases intravenously. Colon lavage is done in severe cases. If urine is not being secreted, linseed poultices are applied to the loins: calcium gluconate and radiostoleum appeared to have some success in a few instances but this treatment was absolutely unsuccessful in other types of toxemia. In this our results differed from those of Cameron<sup>21</sup> although he used practically the same technic. We have tried every treatment that has been suggested, decapsulation, insulin, corpus luteum, the injection of the blood of a woman pregnant about the same period, but in really severe cases the only treatment is evacuation of the uterus. The best method during the first three months is by vaginal hysterotomy, in the next three months vaginal or abdominal cesarean section. Once the child is viable induction by puncture of the membranes suffices. Evacuation should be done, if in spite of treatment the pulse rate becomes irregular and more rapid and the laboratory tests remain unchanged. The general appearance of the patient is of supreme importance, the pinched haunted look with slight icterus will often decide the issue.

*Accidental Hemorrhage*.—It is of great interest to find that this is not included either in the work of Cruikshank or of Stander. The time has come to include it among the toxemias.

A true toxemic accidental hemorrhage is indeed a toxemia. Everything points to it. All observers who have tried to theorize on this subject have failed to find a solution. There is no doubt that there is bleeding between the muscle bundles, but what causes the bleeding? Some toxin? But no one has succeeded in making any *convincing* observation as to the obvious train of symptoms.

We do not intend to theorize further except to suggest that, as excessive swelling of the endothelium of the vessels of the uterus is a marked feature, loss of arterial endothelium occurs, with transudation of blood, through the vessel walls. It is easy to visualize a flow of this escaped blood through the uterine muscle towards the placental site, which may cause hemorrhage behind the placenta, forming a hematoma which not only separates the placenta but makes its way into the substance. In addition to this, disintegration of the muscle fibers allows the hemorrhage to separate them; and the contractible power of the uterus is lost. Gradually this hemorrhage may increase and bleeding occurs into the

uterine cavity and into the serous surfaces. Hemorrhages also occur in the decidua, even into the amniotic cavity and the fetus gradually dies. This is borne out by postmortem examination of the uterus. It is also borne out by the appearance of blood on the serous surfaces of the uterus, in the broad ligaments and in the abdominal cavity. In addition the appearance of serum at the vagina, squeezed from the uterus as the juice is squeezed from an orange, is further confirmation. The exact cause cannot be ascertained; it is different to that of eclampsia; it is nearly always present in multiparae, in fact, so true is this that a primigravida diagnosed as accidental hemorrhage is most likely to be a placenta previa.

Diagnosis is easy; the patient is nearly, but not always, a multipara with symptoms of severe collapse, thready pulse, etc., a uterus painful and tender with impossibility to feel fetal parts, no fetal heart, a vaginal examination revealing membranes bulging and no placenta.

Our treatment will now be considered, and it is of great interest to be retrospective. On considering the various treatments which have been carried out at the Rotunda, it will be found that there has been a gradual feeling against radicalism, and the mild measures have been attended by improved results. During recent years the following treatments for severe concealed accidental hemorrhage have been carried out: Vaginal plugging, nearly invariably fatal; cesarean hysterectomy, fatal; cesarean section, a great improvement; and the present treatment.

One of the most dramatic episodes the writer has witnessed was the first time he saw a uterus left in the abdomen with hemorrhage exuding from the serous surfaces, from the peritoneum of the broad ligament, from the pelvic walls, and the patient recovered. But the results were not good and the treatment which is now carried out obtains most extraordinarily good results, but the details as in eclampsia must be meticulously observed. The treatment is the same for the severe as for the mild cases, except that the former will require more saline and stimulants. When the patient is admitted she is surrounded by hot water bottles, given two pints of saline under the breasts. Then the membranes are punctured, and pituitary extract given in  $2\frac{1}{2}$  unit doses every quarter hour, until if necessary 20 units are given. Delivery takes a variable time but usually four to eight hours sees the termination of labor. The pulse rate must be carefully observed and any increase indicated stimulants and repeated submammary saline. In a severe case intramuscular injections of ephedrine, brandy, ether are given at hourly intervals. Morphine is a routine standby.

Patients do not die of concealed accidental hemorrhage, if the condition is diagnosed in time and the measures suggested are adopted. But the pulse must be carefully observed and any sudden increase in its rate calls for immediate action.

In the five-year period there were 132 cases of toxemic accidental hemorrhage with 5 deaths, a mortality rate of 3.78 per cent.

*Prenatal Care.*—Prenatal care will prevent the occurrence of many

cases of eclampsia, but it will not prevent eclampsism with sometimes fatal results. It should however be insisted upon as the incidence of mortality will be more lowered by care and timely induction in the prenatal period.

Prenatal care is useful in hyperemesis, inasmuch as advice can be given before it occurs; when it is present appropriate treatment can be carried out before the patient is fatally ill.

The onset of accidental hemorrhage is usually so acute that prenatal care at the moment has very little effect on prognosis and treatment.

A SUMMARY OF CASES OF TOXEMIA OF PREGNANCY DURING FIVE YEARS  
AT ROTUNDA HOSPITAL.

1926-1927

1979 deliveries in Hospital

1768 on the District

Albuminuria	360	No death
Eclampsism	21	No death
Eclampsia	12	2 deaths

Treatment same as previously except glucose was started. Morphine reintroduced for eclampsia. Pituitary extract in small doses during colonic lavage. This was done because it had been stated that in small doses pituitary extract had no effect on blood pressure. I proved this to be definitely untrue. A dose of two and one-half units cause a rise in blood pressure so that the use of pituitary extract in this connection was discontinued.

In this year's report, the necessity for revision in nomenclature of eclampsia was suggested.

Twelve cases of eclampsia, 2 deaths, one from puerperal sepsis. The other case was a questionable eclamptic. She had one fit a few seconds before death, probably a death rattle.

<i>Accidental Hemorrhage</i>	23 without mortality.
	20 were toxemic.
<i>Hyperemesis</i>	3, with one death.

This case admitted with icterus. Albuminuria, acetone, diacetic acid. Induction March 24, birth 27, Mors April 3. Minor cesarean section would have been a better treatment.

1927-1928

<i>Intern.</i>		<i>Extern.</i>
2062		1717
Albuminuria	608	no death
Eclampsism	28	1 death
Eclampsia	18	1 death

Biochemical investigations continue to be made; they are helpful but not conclusive.

*Fatal eclamptic* B.M.J. July 1928

Admitted with definite eclampsism; six hours after delivery fits started; eight in rapid succession. Fifteen hours later respirations ceased but pulse remained for two and a half hours P.M. Cerebral hemorrhage.

<i>Accidental Hemorrhage</i>	41 cases	1 death
	25 toxemic	
	Previous toxemias,	7

*Toxemic Death.*

M. C. A primigravida, thirty-five weeks, fits before admission. Blood pressure 118 mm. Hg.

This case has already been described.

*Eclampsism.*

Death due to cerebral hemorrhage into the left ventricle and medulla.

*Hyperemesis*          6 cases          no death  
1928-1929

Intern. 2034		Extern. 1805
Albuminuria	564	no death
Eclampsism	43	no death
Eclampsia	9	1 death

Fatal case, typical, para ix of forty who died of sepsis with bronchopneumonia. She had chronic interstitial nephritis. Extract from this report reads:

"Prognosis for the multiparous eclamptic very grave and I dread her advent in the hospital." (Rotunda Report.)

*Accidental Hemorrhage.*    43 cases    two deaths,  
1. Attended outside, refused to come in, until moribund;  
2. Sent up with plugged vagina. P. P. H. Mors.  
25 Toxemic  
6 repeat

*Hyperemesis*          5 cases          1 death

Fatal case . . . vomiting at five months which continued for two weeks before admission. Patient dehydrated, jaundiced, emaciated. No stomach resonance. Fouchet positive. Spontaneous labor at twenty-eight weeks. Deaths three days after delivery. P. M. Interstitial hemorrhage into uterus. Kidneys showed diffuse fatty degeneration of epithelium of convoluted tubules. Glomeruli distended with engorgement of blood. Interstitial fibrosis. This is acute on chronic interstitial nephritis.

*Liver:* Congestion around central vein with degeneration of liver cells. Old blood in this area. Cells in periphery cloudy, swollen.

1929-1930

Intern. 2258		Extern. 1724
Albuminuria	639	"Is it a normal occurrence?" (Report)
Eclampsism	37	3 maternal deaths.
Eclampsia	8	3 maternal deaths.

*Eclampsism.*

1. Primigravida; blind, nystagmus, vomiting. Cesarean section, recovery. Mors, four days later with mental symptoms.

2. Cyanosed and moribund. Fibrillation.

3. Eclamptic without fits. Blindness. Mors in twenty-four hours.

All three eclamptics had severe cerebral hemorrhage.

*Accidental Hemorrhage.*    41 cases    Toxemie. Normal previous pregnancies.  
1 death

Fatal case. Para viii, secreted no urine during the five and one-half hours in hospital.

*Acute Toxemia.*

1. Para. An unusual toxemia; half an hour after birth, collapse. Hematoma of perineum and vagina without laceration. That is, general hemorrhagic infiltration of

vaginal wall and cervix. Uterus and vagina plugged. Death. No free blood in abdominal cavity but uterine sinuses unusually open. Albumin present in P. M. specimen.

*Hyperemesis.* 7 cases  
1 death

Vagina covered with thrush, also mouth. P. M. Huge intestinal distention and pure blood in cerebrospinal fluid. Vomiting three weeks before admission.

1930-1931

<i>Intern.</i>		<i>Extern.</i>
2169		1755
Albuminuria	738	no death
Eclampsism	19	1 death
Eclampsia	11	1 death

Three toxemias of unknown nomenclature.

1. *M. C.*, para x. No prenatal care. Fit twenty minutes before death. P. M. Report atypical.

2. *E. P. McG.*, para iii with two previous normal births. Two fits prior to admission, recovery, then 29 fits, followed by death.

3. *T. A.* Pallor, cyanosis, vomiting. Two days postpartum very drowsy and died. P. M. Bronchopneumonia. No other abnormal signs.

*Accidental Hemorrhage.* 33 cases, 1 death  
21 Toxemic  
1 Repeat Toxemia

*Hyperemesis.* 3 cases  
*Total Deaths.* 1 Eclampsism  
1 Eclamptic  
1 Accidental Hemorrhage

*Eclampsism.* Para i. Eclamptic without fits. Admitted for induction because of increasing albuminuria. Routine treatment. Low forceps. *Baby toxemic*, died two days later. P. M. Toxemia.

*Eclampsia.* Para ii. Deep coma on admission. Never regained consciousness and died with pontine hemorrhage.

*Accidental Hemorrhage.* Moribund on admission. Did not respond.

#### RESULTS OF FIVE YEARS OF TOXEMIA AT THE ROTUNDA HOSPITAL

Only the first five years of the present Mastership are considered. During this period, there were 10,502 internal cases and 8,719 external cases. As severe toxemic cases are all admitted to the hospital, it seems wise to consider 19,221 cases altogether.

Of these there were

Eclampsia	62 cases	8 deaths	12.9 per cent
Eclampsism	128 cases	4 deaths	3.1 per cent
If both are taken together	190 cases	12 deaths	6. per cent

The cause of death will be found in the Rotunda Hospital Reports.

There were 2,899 cases of albuminuria with no deaths. There were 3 cases of toxemia to which it was impossible to give a name.

These were chronic nephritic cases according to the postmortem examination. But they all died.

Toxemic accidental hemorrhage	132 cases	5 deaths	3.78 per cent
Hyperemesis gravidarum	24 cases	3 deaths	12.5 per cent

In all excluding albuminuria otherwise than eclampsia without fits, i. e., eclampsism, 349 cases, 23 deaths, 6.3 per cent.

## SUMMARY AND CONCLUSIONS

1. The subject of toxemia of pregnancy was chosen because so many points regarding diagnosis and treatment are still inconclusive.

2. The cause of these toxemias is still unknown. If theories as to causation are to be of assistance, successful clinical results must follow their application. The two theories, especially in regard to eclampsia in which food and placental toxins play the chief part, seem to be valid, as they conform to this rule. If patients can be persuaded to attend prenatally they should not, as a rule, die. If they do not attend, no treatment will be of avail in some instances, as cerebral hemorrhage may occur. Of the 8 deaths in this series, 5 had cerebral hemorrhage as shown at autopsy and two died of puerperal sepsis.

3. The varieties of toxemia are numerous. They might be divided into (a) common, (b) rare. Under the former heading would be included albuminuria with marked toxic symptoms, eclampsism, eclampsia, hyperemesis, and accidental hemorrhage.

4. Prenatal care must be insisted on. Results will be better, but there will still be a small mortality.

5. The Fouchet test is a simple and valuable test for liver involvement.

6. The nomenclature of eclampsia must be decided on at an International Congress.

7. The results of an investigation of the eye in toxemia are given.

8. In evaluating statistics of hyperemesis gravidarum investigation should be made as to whether those cases are truly hyperemesis. There is no cure for some of these cases except evacuation of the uterus which can sometimes be carried out gradually; at other times it must be immediate.

9. Toxemic accidental hemorrhage, as its name implies, must be classified as toxemia. It is nearly always curable if treated as soon as it is diagnosed.

10. A summary of cases of toxemia of pregnancy during five years at the Rotunda Hospital is given in which the mortality statistics for eclampsia, eclampsism, accidental hemorrhage, and hyperemesis gravidarum will be found.

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## NEW METHODS OF STUDY APPLIED TO MATERNAL MORTALITIES IN THE HOSPITAL\*

A. J. SKEEL, M.D., F.A.C.S., CLEVELAND, OHIO  
(*Director Division of Obstetrics, St. Luke's Hospital*)

HOSPITAL standards are established for the purpose of increasing the average of efficiency. If we are to improve our standards, we must have an accurate measuring stick for testing the end-results.

During the last decade the challenge has been rather sharply made by certain medical authors, and by an increasing group of lay writers, reflecting their opinions, that the general hospital is not a safe place for the care of obstetric patients. To be more specific, the statement is made that patients delivered and housed in a general hospital, are subjected to undue risk from septic infection.

Statistics are being compiled to support this view, and are even finding their way into obstetric textbooks. Obstetricians responsible for the conduct of maternity wards in good hospitals, knowing intimately the conditions in their own institutions, have understood the fallacies behind many of these conclusions, and secure in this knowledge, have generally ignored these charges. The recent appearance however of an article by a lay writer, in a publication of national circulation, urging women to avoid the "flaming death" of septicemia, by remaining at home or going to a specialized maternity hospital, supporting this view by quotations from an obstetric authority of high standing, should not go unanswered.

The maternity ward in a general hospital, must defend its right to exist as such, must show that the safety of its patients is adequately safeguarded; or tacitly admit as its detractors charge, that it is a mere makeshift, defensible only because of lack of more adequate facilities.

Tables of hospital deliveries and mortalities, as compiled by our Bureaus of Vital Statistics, give rise to several subjects for discussion.

*First.*—Tables which make comparisons between hospitals, based on the ratios between live births and puerperal deaths. The inference is lightly made that the puerperal death rate for a hospital is a criterion of the safety of that hospital for child-birth. The tables of the Cleveland Health Office for 1931 make the following comparisons.

PLACE OF BIRTH	LIVING BIRTHS	PUERPERAL DEATHS	DEATH RATE PER 1000
Home cases	6516	19	2.9
Maternity hospitals	3519	20	5.7
General hospitals	6235	70	11.1
Hospital totals	9754	90	10.

\*Read at the Forty-Fifth Annual Meeting of the American Association of Obstetricians, Gynecologists and Abdominal Surgeons, French Lick Springs, Ind., September 12, 13, and 14, 1932.



Any lay reader might and (to judge from the literature) many medical readers do, conclude that child-birth is relatively safe at home, quite unsafe in a maternity hospital, and positively dangerous in a general hospital. Puerperal deaths consist of deaths from delivery, plus, deaths from abortions, miscarriages, ectopic pregnancies and all the other mishaps of early pregnancy. There is therefore no way to rationalize the computation of ratios between *births* and *puerperal deaths*, as a hospital study. These tables offer no information as to hospital efficiency, or as to comparative merits of various hospitals.

Maternity hospitals have practically no puerperal deaths except delivery deaths. Good maternity hospitals properly refuse to admit abortions, miscarriages, etc., because it is unsafe to house them in maternity wards, or to care for them with the maternity nursing personnel. The general hospital accepts these cases in its medical and surgical wards, and if death ensues, it is a puerperal death occurring in that hospital. These deaths plus delivery deaths are then checked against the number of births, in estimating a puerperal death rate for the institution. A high *puerperal* death rate in a *general* hospital indicates merely that the institution has a large gynecologic and surgical service. It throws no light whatever on the quality of its obstetric service: The measure of the efficiency and safety of a maternity service, is not the *puerperal* death rate of the hospital, but the *delivery death rate* of its *maternity service*. This criterion is accurate for the maternity hospital, and equally so for the general hospital. The *puerperal* death rate and the *delivery* death rate of a maternity hospital may not be far different, but in a general hospital with active gynecologic and surgical services the *puerperal rate* is often twice that of the *delivery rate*.

*Second.*—The method of calculation of death rates is wrong. Child Welfare Bureaus and sociologists are interested in ascertaining the total number of maternal lives lost in producing, e. g., 100,000 live babies, and our vital statistics setup is based on this study. The number of deliveries occurring in a hospital however, is the number of live births plus the number of stillbirths. A birth in our sense is the delivery of a viable fetus. The death rate should not be raised by estimating it from live births instead of from total births.

Figures were obtained from the Cleveland Health Office, showing the period of intrauterine gestation, for each of the puerperal deaths charged against Cleveland hospitals for 1931. We took six and one-half months as a basis for separating viable from nonviable cases. The regular tables gave us the number of stillbirths, which we added to the live births to obtain the number of deliveries.

We found 17 delivery deaths and 3 previable deaths at the maternities, while the general hospitals had 36 delivery deaths and 34 previable. The official tables showed 110 stillbirths at maternities and 240 at general hospitals. Tabulating the comparative results we have the following:

	OFFICIAL FIGURES PUERPERAL DEATHS PER 1000 LIVING BIRTHS	DELIVERY DEATHS PER 1000 LIVING BIRTHS	CORRECT FIGURES DELIVERY DEATHS PER 1000 TOTAL BIRTHS
Maternity hospitals	5.7	4.8	4.7
General hospitals	11.1	5.8	5.5
Hospital totals	10.	5.4	5.2

The general hospital ratio is diminished from 11.1 to 5.5 and the total hospital figures from 10 to 5.2 by correct analysis. The official Cleveland figures are not unique, but are standard forms. Why do we permit the publication of an anachronism so misleading regarding hospital efficiency for obstetrics as a whole, and equally misleading when used to compare the relative safety of different types of obstetric services? The entire cause of American obstetrics is suffering from a lack of appreciation of the difference between puerperal death rates and delivery death rates. Puerperal death rates are a more appropriate subject for a Sunday morning sermon than for comparison of hospital mortalities.

We turn again to Cleveland's official tables. The Cleveland City Hospital had 884 deliveries, with 12 viable and 13 previable deaths. It is like most other city hospitals, a dumping ground for infected cases. Omitting the City Hospital from the list, in order to get a fair idea of the average work of our general hospitals, we find the delivery death rate of the general hospitals, to be 4.5, that of the maternities was 4.7. Allowing for minor errors in estimating viability, etc., the delivery death rate of the two types of institutions was practically the same.

Comparison of hospital deliveries with home deliveries, basing this comparison on the respective death rates, seems to be a favorite pastime for statisticians and lay authors. Disproportion, placenta previa, eclampsia, and cardiac disease, are the cause of nearly all nonseptic deaths following delivery. Practically all of these become hospital cases either before or during labor. Delivery occurs in the hospital, and if death ensues it is a hospital death. These women are sent to the hospital, because the facilities, technic, and professional skill which the institution provides, can save many of them who would certainly die at home. This is common knowledge, yet we permit without effective protest, the publishing of comparisons which are utterly misleading. The entire subject of hospital maternal mortalities needs detailed continuous study by obstetricians.

#### THE CLEVELAND PLAN

Early this year at a conference of the obstetric heads of several Cleveland hospitals, an organization was perfected to give this matter continuous attention, and to assemble the information so obtained, in suitable form. Every hospital in the city with an organized maternity depart-

ment, is invited to participate in our conferences. The only requirement is that the hospital shall cooperate by making detailed reports of its own puerperal deaths. For the purpose of this study we have classified these deaths as follows:

- A. Puerperal deaths
  - (1) Viable (following deliveries)
  - (2) Previsible (following abortions, ectopics, etc.)
- B. Viable
  - (1) Septic
  - (2) Nonseptic
- C. Septic
  - (1) Intra hospital infections
  - (2) Extra hospital infections
- D. Nonseptic
  - (1) Sent to hospital for known pathologic conditions
  - (2) Admitted as normal cases

We accept 1500 gm., or six and one-half months, as the period of viability. In the nonseptic group fall the cases of late toxemia, eclampsia, late hemorrhages of placenta previa, and ablatio placentae, cases of cardiac disease, shock, early pneumonia, early emboli, etc.

In the septic class we place all the frank infections, the late pneumonias, late emboli, nonobstructive ileus, etc. Patients admitted with fever or developing fever within twenty-four hours after admission, are classed as extra hospital infections. Patients admitted after intrauterine manipulations, such as unsterile packing for placenta previa, prolonged attempts at delivery by forceps or version, are also considered extra hospital infections.

The group consisting of obstetric specialists from the various hospitals, sits as a jury on each case. Each hospital presents its own report without naming either patient or physician. These reports not only give information from the chart record, but additional facts obtained from the attending physician. The reports are checked by our secretary, who obtains from the Health Office, records of all puerperal deaths.

Seven of our general hospitals, with approximately 13,000 births in the years 1929, 1930, and 1931, showed 17 septic cases which terminated fatally. Ten of these were of extra hospital origin. In 7 no extra hospital cause was evident. Not all of these however should be attributed to hospital conditions. Late coitus, self examination, and personal uncleanliness, are well recognized sources of vaginal contamination at the time of labor. It is also apparent that the 10 cases of extra hospital infection, and many other similar cases occurring in other hospitals, should be added to the deaths attributed to home deliveries.

We feel that here is a field, well deserving study over long periods and by many groups. Valuable information of a type not now available could be acquired by this means. It is in the hope of stimulating such group study, that we have presented our plan.

The writer has no desire to defend carelessness in the supervision of obstetric work in a general hospital. Any institution which permits medical, surgical and obstetric patients to be housed in the same units, and to be cared for by the same personnel, is inviting tragedy. He does believe however that the suitably placed obstetric unit, serviced by a properly segregated personnel, and adequately supervised, is safe from the myth of "air borne" infection. At St. Luke's the following precautions are taken to ensure proper isolation of the obstetric division.

A. Labor rooms, delivery rooms, and obstetric surgery, are entirely isolated physically on the top floor, with no corridors connecting with any other part of the hospital.

B. Patients' rooms, nurseries, etc., on the third floor, directly beneath the delivery rooms. The connecting corridor is closed by folding doors, which may be opened only for purposes of fire or other emergency.

The following rules and regulations are rigidly enforced:

1. Before student nurses begin their services in the maternity department, they shall be away from the hospital for a day. During the day, they must take a bath, shampoo, change all their clothes and have their shoes cleaned.

2. (A) No nurses who are working in the maternity department shall be permitted to work in other departments. (B) Nurses working in other departments shall not be permitted to work in the maternity department.

3. All nurses working in the maternity department must pass a rigid inspection of fingers, hands, and arms, by the resident or the assistant resident and the supervisor of obstetrics, when they come on duty.

4. Maids and janitors working in the obstetric department, must pass a daily inspection before they begin work.

5. All linen from the obstetric division shall be laundered separately from the other hospital linen.

6. Patients with fever or other evidences of infection, shall be promptly removed from the obstetric division.

There will of course be many necessary variations from the details of these rules; but any hospital general or specialized must accept the principles of isolation upon which these rules are based, if its patients are to be adequately protected.

#### CONCLUSIONS

The ratio of puerperal deaths to live births in hospitals, throws no light on their relative efficiency. The custom of presenting such comparisons for this purpose is misleading and should cease.

Properly administered and well supervised obstetric departments, whether in general hospitals or in specialized maternities, show similar obstetric mortalities, although their puerperal mortalities may be quite different.

We have presented a simple and inexpensive plan for continuous study of obstetric mortalities as found in our large city hospitals. We believe that such group studies will lead to more careful diagnoses, stimulate autopsies, and develop improved methods and higher standards.

## ABSTRACT OF DISCUSSION

DR. JAMES R. McCORD, ATLANTA, GA.—Obstetric mortality *must be considered* in terms of obstetric care and obstetric environment. It is my opinion that the improvement of obstetric environment is more rapid than that of obstetric care.

In considering the mortality statistics of the average maternity hospital and the average general hospital, I think that the difference is not because of the hospital, its system, isolation, etc., but because of the better obstetric judgment that is more generally obtainable in the maternity hospital.

Dr. Skeel made the following statement, "The entire subject of hospital maternal mortalities needs detailed continuous study by obstetricians."

I would paraphrase that sentence as follows: The entire subject of hospital maternal mortalities needs detailed and continuous teaching, by obstetricians, of physiologic labor along safe, sane, and conservative lines.

It has been my privilege to assist in the individual study of some 7500 maternal deaths occurring in this country. Of those deaths that were probably preventable, where lay the fault? In a certain number unquestionably with the patient herself—but in a vastly larger group the fault was an error of obstetric judgment. Hospitals, equipments, systems, nurses pale into insignificance when compared with a thorough knowledge of the physiology and mechanism of labor. I have made the statement many times that if obstetric mortality and morbidity are to be permanently improved in this country, it will be because medical schools are consistently graduating doctors well trained in the fundamentals of the obstetric art. To obtain the maximum of improvement, women must be educated to an appreciation of the fact that obstetrics is an art—and taught what good obstetric care really is. Studies of maternal mortalities, as outlined are instructive and stimulating, but in the final analysis obstetric mortality is a direct responsibility of our medical schools and obstetric teachers.

DR. JAMES R. MILLER, HARTFORD, CONN.—When we consider our figures for hospital delivery mortality, I think we should also compare certain other data, such as population of the different cities, or the percentage of hospitalization which occurs in any community. Where Negroes, French Canadians, Irish, or Poles are numerous the mortality is likely to be higher. In communities where Russians, Italians and Jews make up the largest part of the hospital population the mortality should be very low.

I can second the idea put forth by Dr. Skeel that the separate unit in a general hospital can be run successfully with a low mortality. Our hospital has made a study, covering fifteen years and the mortality is shown to be under 0.28 per cent, in spite of a very liberal use of cesarean section and of interference with low forceps. This covers the private cases. My own experience on the ward service for over twelve years shows an exactly equal rate. So we feel that the restrictions put upon the general hospital are not thoroughly warranted. The hospitalization figures in Hartford run up to 87 per cent, and, of course, our statistics are diluted by a large number of normal cases. If one compares the death rate reported by DeLee for the Lying-In Hospital in Chicago, 0.237, with the Royal Maternity in Glasgow of 2.7, it is obvious that it is *not* eleven times more dangerous for a woman to have a baby in the latter hospital than in DeLee's. The whole setting of the institution has to be taken into consideration. The Royal Maternity is the dumping ground for all bad obstetrics. In comparing different institutions these differences must be kept in mind.

DR. CHARLES S. BACON, CHICAGO, ILL.—I agree that there should be a change in the way of collecting statistics. To compare delivery statistics with the statistics including all the postabortal deaths is confusing. The number of deaths following abortions may vary greatly; I believe they have increased in recent years. That, of course, would increase the puerperal death rate. There should be, then, a delivery death rate and a postabortal death rate considered separately.

The efforts that are being made in Cleveland to have cooperation of the hospitals in maternity records, seems to me of great importance. So far as I know that has not been done in any other large city, and it cannot result in anything but a great improvement, not only in the study of the maternal death rate and maternal morbidity, but also in the improvement of the technic. Unless that is done, can we expect any improvement in obstetric teaching? The teaching is done largely in the fifth year, on the interne service. If the interne teaching is not done properly, didactic teaching will be of little value. This cooperation of the maternity divisions of the hospitals should improve not only the interne teaching but the general technic, which will go far toward improving the statistics.

DR. SKEEL (closing).—Dr. Mendenhall is quite right; this is a protest against the publication for general consumption of figures comparing the work and efficiency of general hospitals and maternity hospitals, on the basis of puerperal mortality instead of delivery mortality. We merely analyzed the official figures, and showed that the delivery death rate of the two types of institution were the same. This shows the fallacy of the present methods of comparison.

The group study method has proved very satisfactory in Cleveland. It has developed a proper basis of classification, and shows the erroneous conclusions arrived at by older methods.

Another advantage of such a group organization is: when we as a group make certain recommendations for hospital care of patients, that recommendation goes to the hospital superintendent with more authority than when merely urged by a member of his staff.

With regard to home delivery death rates, we have been able to demonstrate that home deliveries in Cleveland are practically normal deliveries. If a patient has demonstrated disproportion by long labor at home she is sent to the hospital; if she develops eclampsia, she is sent to the hospital; if she shows signs of placenta previa, she is sent to the hospital. Yet comparative death rates are published as if the two conditions were parallel. Some writers accept these comparisons as if they demonstrated hospital inferiority. In fact they demonstrate its recognized superiority.

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Matters, R. Francis: Torsion of Ovarian Cyst With Bradycardia. *Brit. M. J.* 1: 1022, 1931.

The author reports a case of torsion of a parovarian cyst in a twenty-year-old girl with a preoperative pulse rate of 32. The pulse slowly returned to 84 shortly after the operation. An inflamed appendix was also found. The writer theorizes that the torsion stimulated the vagus nerve thus slowing the heart, producing this deceptive sign of peritoneal involvement.

ARTHUR B. HUNT.

Stahnke, E. N.: Diminution of Pain in Operative Gynecology and Obstetrics. *Monatschr. f. Geburtsh. u. Gynäk.* 87: 144, 1931.

The anesthetic which has the lowest mortality is ether which causes on the average only one death in 5,000 cases. The next safest anesthetic is lumbar anesthesia. The German figures for nitrous oxide are unsatisfactory. The death rate from avertin has not yet been determined. Where deaths from postoperative pneumonia are considered, ether exacts the greatest toll. Concerning damage to the heart and blood vessels, nitrous oxide is the greatest offender, and ether the next. Likewise lumbar anesthesia and avertin produce disturbances in the circulatory apparatus. Nitrous oxide and lumbar anesthesia, on the other hand, never cause damage to the liver and kidneys but avertin produces serious and ether mild disturbances. Lumbar anesthesia is the only one which brings about nerve injuries.

# PREVENTION AND CONTROL OF MORBIDITY AND MORTALITY FROM (PUERPERAL) INFECTION BY STATE OR MUNICIPAL SUPERVISION AND INSPECTION\*

CHARLES S. BACON, PH.B., M.D., D.Sc., F.A.C.S., CHICAGO, ILL.

ACCORDING to the International list of the causes of deaths that is now adopted by the United States Census Bureau, puerperal infection comes under three headings: Abortion with septic conditions (Heading 140), ectopic gestation with septic conditions (142a), and puerperal septicemia (145). It should include puerperal phlegmasia alba dolens and septic embolism, which are now combined with sudden death in heading 148. The mortality rate is generally computed as the ratio of puerperal deaths to one thousand live births. When deaths from abortion are included in puerperal mortality it would evidently be more reasonable to compare the number of deaths with the number of both live and dead births, including under the latter term all abortions. Because of the difficulty of getting reports of abortions and for other reasons, the other method of calculating death rates is generally adopted. What particularly interests us in obstetric practice, however, is the delivery mortality rates, i. e., the ratio of the number of delivery deaths to the number of children of viable age both dead and alive. Abortion is quite another obstetric problem. The causes of intra- and postabortal mortality are so different as to require special consideration and the treatment of abortion is quite different from that of labor with viable child. The cases are also handled in special departments of hospitals. Moreover the frequency of abortion varies in different periods and if its statistics are combined with those of labor and puerperium, they will cause confusing fluctuations. We shall be obliged, however, to base our discussion on the generally accepted mortality tables.

We do not propose to compare the puerperal mortality in the United States with that of other countries nor that in the different states or cities or rural districts nor that in hospitals versus homes. Several recent papers by both American and European writers have made valuable contributions to these questions. We start out with the generally admitted fact that the mortality rate is higher than necessary and that in the country at large it has not decreased much in recent years. Only puerperal infection is considered because that is in the list of reportable infectious diseases in many states and hence, the principle is already established that it is the duty of the state to seek to control it. No serious effort has yet been made, however, by any state to carry out a system of adequate supervision of hospitals and private practice that would procure results. We shall attempt

\*Read at the Forty-Fifth Annual Meeting of the American Association of Obstetricians, Gynecologists and Abdominal Surgeons, French Lick Springs, Ind., September 12, 13, and 14, 1932.

to show that because of the failure of other efforts the states should now undertake this task.

The methods of supervision and inspection would probably differ in different states. Whether it be undertaken by the State Department of Health or Department of Public Welfare, or whether it be delegated to municipal or local health bodies will depend upon the organization that has developed and that now functions in different states. If the need of supervision is recognized in all the states and the right and duty of the state to interfere is accepted, the ways will be found.

Probably some uniform system of hospital scoring would eventually be introduced. On score cards, similar for example to those used in milk control, would be recorded, the rating of the hospitals in equipment, organization of the maternity service and performance. The relation of morbidity to mortality, i. e., the number of cases of puerperal infection to the number of deaths would be established as it is now done in the Appraisal Form for city health work of the American Public Health Association. Scoring of the maternity work in the different cities, towns, and rural districts could be carried out in a similar way by the state department.

In introducing hospital supervision and control of puerperal infection, it might be well for certain cities to experiment and try out their own plans in order to find out which works most satisfactorily. The best way to secure hospital and professional cooperation, determine the requirements for hospital equipment and organization, and the frequency and nature and cost of inspection, etc., could thus be established. An attempt to secure agreement upon the principles underlying state inspection and upon the best way to carry it out could be made by discussions at the annual meeting of the State Health Officers with the Surgeon General of the United States Health Service. Naturally the matter would also come before the American Public Health Association, as well as the American Medical Association, the American College of Surgeons and other medical societies.

The state can, and does, exercise authority over physicians and hospitals in the matter of vital statistics, when it requires reporting of births and deaths, and specifies how reports shall be made. In other ways also the state shows its power to control medical practice. Physicians, midwives, and nurses must be licensed after examination, and their licenses may be revoked for incompetency or misuse. Hospitals also must procure licenses and this implies the right of the state to inspect the character of the personnel, the equipment, the rules, and the management. Likewise the state has the right and the duty to prevent and control contagious diseases. This gives the state the right to inspect maternity hospitals, demand proper equipment and the establishment of rules for the prevention and control of puerperal infection, because this is an infectious disease. In the case of patients delivered in their homes, infection is in the same category, reportable infectious diseases, as other kinds of infection or contagion,



like scarlet fever or typhoid. Reports of cases of puerperal infection can be required, and if deaths occur where no report has been made, the attending physician can be punished as when death occurs in a case of unreported scarlet fever.

Other methods of preventing mortality from puerperal infection have proved insufficient. The Fellows of this Association know that the mortality from puerperal infection over the whole country has not been substantially reduced in the last fifteen or twenty years. This is true in spite of efforts on the part of members of the profession and of the laity. Better obstetric teaching has been advised and better training of nurses and midwives; prenatal clinics have been established. For seven years under the operation of the Sheppard-Towner Law, the resources of the general government were added to those of states for this purpose but apparently with little result. The Sheppard-Towner Law no doubt has caused a considerable lessening in the death rate of infants. It did good in educating the people to the appreciation of the importance of good obstetric care and calling the attention of the medical profession to the needs and demands of the community. It is not unlikely that in time it would have accomplished something in reducing puerperal infection, but that was too big a problem to be solved in seven years. One of the chief aims of those who administered the law was to care for pregnancy through the establishment of prenatal clinics. This was important and probably had some effect in diminishing accidents of pregnancy, including toxemia. Infection occurs, however, during, and shortly after labor and is controlled by prenatal clinics only as they improve the health and increase the resistance of the gravidae.

Better education of medical students and of nurses and midwives ought to accomplish something. Parenthetically, it may be said that midwives have generally been ignored by medical schools and are probably neither better nor worse now than twenty years ago. Their practice is declining in most sections of the country and if infection is more common with them, this fact should show in the improvement of the mortality rates. In European countries which have well trained midwives, the incidence of infection in their practice is said to be less than in the practice of physicians. More attention has been given lately to obstetric teaching of embryo doctors and nurses. Why has this failed to produce results? Didactic teaching does not help much in preventing puerperal infection. Clinical teaching is of chief importance. Here the trouble lies. Few schools have enough clinical material to furnish 25 to 30 cases for each student, the number that is agreed upon as a minimum. Often the cases are not used to best advantage. The most important clinical teaching comes in the interne year. It is given mostly in general hospitals, not under the control of school teachers. Here the student often learns a poor technic and a highly developed meddlesome midwifery. What can be expected of a young doctor emerging from a hospital which has a record of 30 to 50 per cent of forceps operations and a proportional number of versions and cesarean sections done mostly by general practitioners.

The great increase in the number of patients delivered in hospitals, which has now reached about 66 per cent in the cities with hospital accommodations, was at first hailed with joy as promising great improvement in obstetric practice, but recent studies in this country and abroad seem to show that it has not improved the mortality rate from puerperal infection. The number of obstetric operations has increased. Patients are coming to demand short and painless labors. The enormous increase in operative interference is not accompanied by increased operative skill on the part of the physician, nor satisfactory equipment and technic in the hospital. This leads to increased infection that is largely responsible for our failure to improve our mortality and morbidity rates.

One fundamental mistake made by general hospitals that accept obstetric patients is the failure to separate these patients from the rest of the hospital. Frequently no preparation room is provided. Patients are prepared in the surgical preparation room or in the delivery room. No special internes and nurses are provided for the delivery room. Puerperae and medical and surgical patients are kept in the same wards, use the same bedpans, and are cared for by the same internes and nurses. Managers of small hospitals will say that it is impossible to separate obstetric patients and provide separate obstetric and nursing care for them. The obvious answer would be that these hospitals should not be allowed to receive obstetric patients. That would hold for cities where proper accommodations could be found in other hospitals. In small towns, however, this answer would not be accepted. When a small hospital is built, it should be planned so that rooms to be used for maternity patients are separated from the rest of the hospital, so far as possible. Special caution in caring for patients would avoid much of the danger. Frequent inspection of such hospitals would, if wise and thorough, help much.

Efforts have been made by the American Medical Association and the American College of Surgeons to improve hospital methods. Perhaps some progress can be made in this way, but these bodies lack the authority of the state which by its licensing power can command when the associations can only advise. The Cleveland plan of cooperation of the maternity departments of hospitals described by Dr. Skeel, is more promising if it could be generally adopted. While the state cannot, and should not, dictate the practice of physicians, it can require proper conditions in hospitals for safe operative interference and management of normal labor. That such a supervision would be supported by the best hospitals is shown by the results of a questionnaire sent to the hospitals of Chicago a few years ago by Dr. Bundesen, Commissioner of Health of the city. The general plan of inspection and the rules about to be given were generally approved. Well appointed and well managed hospitals have nothing to fear from such a plan and believe that it would be a help to carry out their own regulations. It would be foolish of course to ignore the difficulties in the way of a health administration that should inaugurate such a hospital supervision. Low grade hospitals and physicians would object when their faults were dis-

covered and corrections demanded. No health officer could withstand the political pressure that would be brought to bear upon him unless he had the support of the medical profession and of the welfare-conscious groups of laymen.

The following recommendations for the installation of a system of hospital inspection or supervision including rules for control of puerperal infection are presented for your consideration.

#### RECOMMENDATIONS FOR HOSPITAL INSPECTION

Puerperal fever is an infection of the birth canal due frequently to mistakes in the technique of delivery or in the care of the patient after delivery and hence is, with few exceptions, preventable. Confinements, like surgical operations can be conducted much better in hospitals than in homes, provided that the hospitals are properly equipped for the care of maternity cases and that proper rules for their management are made and enforced. It is the duty of the Health Department to ascertain that every hospital with an obstetric department has proper equipment and technique which is continuously enforced. For this reason the Department should institute a system of inspection, either by the creation of a Bureau of Hospital Inspection, or by adding full time physicians as hospital inspectors to the proper existing Bureau of the Department.

Besides the duty of helping to prevent and control the spread of puerperal infection, such inspectors could also be entrusted with a similar function in other hospital infections in the medical, pediatric, and surgical departments and in the inspection of the general hospital sanitation.

The persons selected as hospital inspectors should be full time physicians who have had hospital experience, either on the resident or attending staff as well as considerable experience in the management of contagious diseases. They should have tact and common sense and understand that as representatives of the Health Department they are to cooperate with the hospital for the good of the patients and not create antagonism by arbitrary actions.

The inspectors should visit the hospitals frequently, weekly if possible, especially those in which infection is found to exist and those poorly organized and equipped. At the first visit they should see that the preparation, labor and delivery rooms are properly equipped, that an efficient technique in the delivery room and the puerperal wards has been inaugurated and that the records are properly kept. They should see that rules of technique are formulated and posted and if necessary they should assist in making or revising such rules. At later visits they should examine all records of cases with puerperal fever and suggest measures to prevent the continuance of the causes.

#### GENERAL RULES FOR CONTROL OF PUERPERAL INFECTIONS

The following general rules are recommended to hospitals to prevent puerperal infection.

I. The obstetric staff of the hospital shall be responsible for the formulation of rules, for the management of the delivery room, and for the care of the puerperae and for the carrying out of these rules.

II. To prevent infection during labor the following things should be noted:

a. Vaginal examinations shall be made only after thorough aseptic preparation of both patient and examiner. In making rectal examinations every precaution shall be taken to avoid contamination of the vulva and perineum.

b. A clean delivery room. This implies that the preliminary preparation of the patient including the enema, bath, cleaning and shaving of the genital region, etc., should be done in a separate room and not in the labor or the delivery room. When in an emergency a patient must be prepared in the delivery room, special pains must be taken to clean it after labor. Similar care should be taken after delivery of a patient who has developed fever before or during labor. Every person admitted to the delivery room should be free from any skin or throat infection, and covered with a clean cap and gown. Admission should be restricted to those needed for the conduct of labor.

c. There should be provided in the delivery room sufficient sterile and other supplies for use in any normal or pathologic labor.

d. The delivery room should be in charge of a competent nurse who should have enough assistance so that a nurse with good obstetric training will always be present at every delivery.

e. There should be one or more internes who have nothing to do with pus cases who should be always on call for service in the delivery room.

f. All doctors and nurses conducting or directly assisting in the delivery of a patient should wear masks, sterile gowns, and gloves.

g. Rules for the delivery room should be formulated and posted.

h. As operative interference increases the danger of infection, unnecessary operations should be discouraged, which can be done to some extent by requiring the indications for all operations to be given on the patient's history record before the operation.

As the danger of infection is much increased in serious operations including high forceps, cesarean section, version and manual removal of the placenta, and in the serious complications of labor such as antepartum hemorrhage, convulsions, postpartum hemorrhage, etc., consultation on these cases with members of the obstetric staff or some other recognized obstetric authority should be required in all cases.

III. To prevent infection after labor, special attention must be given to the cleaning of the genital region and to the vulvar dressings.

If a patient has a temperature of  $100.4^{\circ}$  or over, infectious precautions should be ordered including tagging the bed, a special bedpan, and any nurse caring for her should wear a special gown and gloves.

If a patient has a fever of  $100.4^{\circ}$  or over twice on each of two successive

days or a chill with high temperature, with symptoms of septicemia or pyemia, she shall be isolated from normal puerperae and cared for by a nurse who does not attend afebrile maternity patients, and who observes all standard rules for the care of patients with communicable diseases.

IV. No operations on patients with incomplete abortion shall be done in the delivery room. Abortion cases with fever shall not be cared for on the maternity service.

V. All cases of fever in puerperium shall be reported daily to the superintendent of the hospital and to the staff obstetrician on service, and such records shall be at all times accessible to the hospital inspector.

VI. All cases requiring isolation as described in Rule III shall be reported to the Health Department.

In the control of infection in patients delivered in their homes, reliance must be placed chiefly upon reports of severe infections as defined in Rule III. The difficulties in securing such reports might be less than in cases of contagious diseases, for no quarantine or placarding of domiciles would be necessary. The acquiescence of midwives could be secured by instituting yearly or periodic license, and this could be used to inspect their equipment and ability. The cooperation of physicians could be facilitated by the efforts of medical schools and societies. Few operations are now done in homes. As operative interference is directly or indirectly the most important factor in puerperal infection, mortality from this source would be less in homes than in hospitals. The moral effect of a system of maternal supervision would alone have considerable influence in home practice.

I have not dwelt upon the need of reducing puerperal infection. This is not one of the chief causes of death like tuberculosis, pneumonia, or cancer. It kills about as many as diphtheria and more than twice as many as scarlet fever or typhoid fever. It takes a toll of about 5,000 women a year, and these are the mothers, the most important members of the community. It also costs much illness and permanent disability. Its control is a great desire of the women of this country. It led to a crusade of the newly enfranchised women voters in 1920 for the passage of the Maternity and Infancy Welfare Act, the Sheppard-Towner Bill. It causes them to continue action to secure the passage of similar measures to replace that law that expired in 1929. It is the desire of every physician who has witnessed the grief and despair of families bereft of mothers lost unnecessarily.

2333 CLEVELAND AVENUE.

#### ABSTRACT OF DISCUSSION

DR. E. D. PLASS, IOWA CITY, IA.—There is no doubt of the need for improvement in obstetric mortality, but personally I doubt whether much can be accomplished under present conditions by any sort of government regulation. The Sheppard-Towner Act has elicited such widespread disapproval of the governmental interference with the practice of medicine that I am quite convinced that statutes of that sort, meeting such opposition as they do, can accomplish very little good. Certainly, the experience has been that obstetric conditions may be improved much more easily under a system of

hospital regulation, where the staff of the hospital interests itself in the character of obstetrics done and insists that consultation be called before any of the more serious obstetric procedures are carried out. Obviously such regulations are more applicable to the larger hospitals, whereas the situation is most serious in the smaller institutions. But even in the latter I doubt whether any sort of government regulation can in the present state of society be of much use; public opinion must be aroused.

There is, however, one phase of the problem which can be carried out without too great opposition. There is relatively little accurate information concerning the character of obstetric practice as a whole. We have statistics from the larger hospitals and cities but practically nothing from smaller communities, and we should have composite data. I have been attempting to get such figures from the State of Iowa by the inclusion in the regular birth certificate of a statement from the doctor regarding the character of the delivery. While these data have not yet been fully analyzed, some very interesting statistics have appeared. For example, among 40,000 births scattered throughout the State of Iowa, the cesarean incidence has been one per cent. There were 400 sections in the 40,000 deliveries. In the communities of over 10,000 population the hospital incidence of cesarean section was 3 per cent, while in the smaller community hospitals the cesarean incidence was 3.3 per cent. In home deliveries the incidence was 0.3 of 1 per cent. As Dr. Bacon has suggested, the hospital admission of patients leads the doctor generally to more interference than he would commonly undertake, and the relationship between interference and infection has been so thoroughly pointed out that it need not be discussed. In the 400 cesarean sections done there were 32 stillborn children; 8 per cent of the cesarean sections were done in the presence of still births, which indicates nothing wrong with the institution itself but rather with the training of the doctors who believe that cesarean section is a reasonable procedure for the delivery of dead children.

DR. JAMES K. QUIGLEY, ROCHESTER, N. Y.—Dr. Bacon has given us something to think about. If the medical profession cannot or will not solve this problem, there is no question I believe, as to the authority of the State to attempt to regulate it. The program of maternal care as inaugurated under the Sheppard-Towner law, was not continued long enough to prove or disprove its value. To be sure, the emphasis was laid upon prenatal care but it at least was educational in pointing out the importance of good care at delivery. Of 946 women who received prenatal care in the State Clinics in New York in 1931 and were delivered, only one mother died and the cause was placenta previa and postpartum infection. Similarly in Westchester County of 1507 women attending prenatal clinics in the past seven years, there were only 4 fatalities, a rate of 26.8 per 10,000 or one-third the mortality rate of the entire district in 1931. Another feature of this work in New York State was a series of postgraduate lectures to County Medical Societies. These included the discussion not only of prenatal care, but the conduct of labor, normal and pathologic, with the emphasis placed upon conservative obstetrics. Here I think is a possible method of attack provided it were enlarged upon and continued.

I agree with Dr. Bacon that the embryo physician obtains his real impressions in clinical obstetrics more from his attending staff in his internship than from his teachers in medical school and a great responsibility and obligation is that of the staff obstetrician. Not only by his teaching but by his example will he influence the younger man, and how can one expect to make conservative obstetricians of internes who daily see their teachers employ operative procedures with scant or no indications in a large percentage of private patients? Dr. Bacon's recommendation that the small general hospital accepting maternity cases and improperly caring for them should be prohibited from taking maternity cases until it has cleaned house and complied with rules, is a good one. The general hospital's responsibility in the present high mortality rate

has been overemphasized. There are many general hospitals with separate obstetric departments and staffs where as good work is done as in the special lying-in institutions.

Dr. Bacon has formulated a good working plan for hospital inspection, more far-reaching than that of the American College of Surgeons or the American Medical Association, where it seems to me an undue emphasis is placed upon maintenance of records and holding of staff meetings, to the neglect of an appraisal of the clinical work and its results in any institution.

I endorse emphatically every paragraph of Dr. Bacon's rules for the conduct of a maternity hospital and in addition would include a regulation that all nurses and internes be compelled to report any skin infection, no matter how trivial, and any acute illness such as erysipelatous sore throat before going on duty in the morning. There have been several epidemics of puerperal sepsis directly traceable to streptococcal sore throats.

DR. ARTHUR J. SKEEL, CLEVELAND, OHIO.—It was my privilege yesterday to show that large general hospitals can do good obstetric work. It seems to me that the trouble occurs largely in the small hospital where obstetrics is done only incidentally. It becomes desirable to do some obstetric work and the hospital allows its doctors to do this without giving any consideration as to how cases can be handled. It may be necessary to use the licensing power of the State to regulate the acceptance of such obstetric cases in the hospitals. It occurred to me that there might be some objection on the part of the medical profession to such control, and I think that whether this control should be made by the county, city, or state government, it would be well for the medical profession to keep their fingers on this control. This would do away with much of the fear of governmental regulation of medical practice.

DR. JAMES F. BALDWIN, COLUMBUS, OHIO.—Several years ago, at Grant Hospital, we thought there were altogether too many cesarean sections performed. The Obstetrical Staff, therefore, had a meeting and unanimously adopted a rule that no one should be permitted to perform a cesarean section, do a high forceps operation, a version, or induce labor, without consultation with one of four men, of whom I happen to be one. If one of the four has a case, he must consult with one of the others. This program has always worked beautifully, and with a marked diminution in the performance of these operations. We have felt that an obstetrician who is tired out with long attendance on a case, is not a good judge of the desirability of operative interference, but that a fresh man called into the case would exercise much better judgment.

DR. BACON (closing).—The possible objection of physicians to the establishment of a system of inspection, of course, has to be recognized. No health officer would undertake any measure of that kind without the support of the medical profession and I think the suggestion of Dr. Skeel is most valuable, that these inspectors should be nominated by the medical society. If the medical societies and the better element of the medical profession would cooperate with the health department in such inspection many of the difficulties that are anticipated would disappear. In regard to what Dr. Quigley said about the investigation of cases of death by the State, that is, of course, important but it is a little like locking the door after the horse is stolen. It may discover the horse, and it may discover how the stealing occurred, but it does not save the horse, in this case the mother. Therefore, the supervision that will prevent death is something that should be added. It is only with the cooperation of all of the elements of the community, the layman, the medical societies, and the state, that results can be accomplished. Medical teaching has not succeeded completely in the past and we must remember that the great majority of physicians graduated years before the better teaching was in vogue and their work needs special control.

# A STUDY IN CORRELATION OF THE SEDIMENTATION TEST, FILAMENT-NONFILAMENT, AND THE WHITE CELL COUNT IN GYNECOLOGY\*

H. WELLINGTON YATES, M.D., DAVID M. DAVIDOW, M.D.,  
ELIZABETH PUTNAM, AND FRANCES ELLMAN,  
DETROIT, MICH.

ANY movement to determine the infectiousness of a given case is quite worth while. Since we have so often been misled by the clinical findings as to the acuteness of disease, the profession at large has depended more and more on the white cell count; it is with this thought in view that we present the following:

The sedimentation test in gynecology has been the subject of considerable discussion during recent years with conflicting reports for and against its value in the diagnosis of pelvic conditions. Since a considerable amount of material was at our disposal, it was decided to carry on this test routinely on all cases admitted to the Gynecological Service at Receiving Hospital, Detroit, for a period of one year and to correlate the results on the patients operated upon for that period. During that time (1929 to 1930) very little or no attention was paid to the test as a diagnostic aid or as an aid in prognosis. It was our aim to settle definitely in the minds of our staff the value of the sedimentation test in gynecology. All the operated cases were reviewed at the end of 1930 and the sedimentation rates checked with the pathologic diagnoses and the average rates for the various conditions noted. This study had been undertaken previously two or three different times without any conclusive results. The reason for this was due apparently to the fact that inexperienced technicians, i. e., students and internes, carried on the work and the results were not at all uniform. During this particular study only experienced laboratory technicians have done the work and the technique has not varied, as a result the tests have been quite consistent with the clinical findings so that fairly definite conclusions could be drawn.

Since that probationary period of one year, the test has been used routinely and in order to bring it up to date, the operated cases for the past two years have been added to the first table. In addition, during the past few months, we have used routinely the filament-nonfilament count as developed in its simpler manner by Farley, St. Clair, and Reisinger, to check this new laboratory test with that of the sedimentation and white cell count. We hope to present here our findings in relation to these various tests and to determine which one is the most sensitive and valuable adjunct to the gynecologist's armamentarium.

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\*Read at the Forty-Fifth Annual Meeting of the American Association of Obstetricians, Gynecologists and Abdominal Surgeons, French Lick Springs, Ind., September 12, 13, and 14, 1932.



The settling out of the red blood cells from the serum is not a recently discovered phenomenon; Galen observed this reaction almost two thousand years ago. John Hunter also made this observation in the latter part of the Eighteenth Century, and he also described the variation in sedimentation rates in different species of animals. Various investigators from time to time reported the same observations, but did not correlate their results clinically. Fähræus, in 1907, was the first to note the variation in sedimentation rate which occurred in pregnancy, infectious states, and in different periods of the same disease; his work was amplified by Linzenmeier who particularly placed the value of the test in the field of gynecology.

The exact biochemical changes which account for the variation in sedimentation rate of the red cells, are still unknown, but there are a number of theories advanced for this phenomenon. The most commonly accepted one is based upon the number of negative charges carried by the erythrocytes; as the negative charges are taken off, either by positively charged agglutinins present in the blood, or by the globulins whose presence increases the viscosity and decreases the negative charges, the red cells no longer repel each other and tend toward an increased rouleau formation. The more marked is this rouleau formation, the shorter is the time that it takes for the cells to settle out.

In our clinic, a definite routine was carried out for all patients. Every patient had a sedimentation test on admission in conjunction with other laboratory work. In addition all blood counts were accompanied by sedimentation tests which meant that all operated cases had this test twenty-four to forty-eight hours prior to operation. During the study of the filament-nonfilament count, this additional information has been added to the patient's record and the old type of differential count has often been dispensed with. The operative cases were chosen by the staff on the basis of the following requisites:

1. History.
2. Pelvic findings through bimanual and speculum examinations.
3. Absence of elevated temperature, except in cases of culdesac abscesses.
4. White blood cell count of 10,000 or less with a corresponding differential count, except in cases of pelvic abscesses.
5. Absence of complicating factors; such as kidney pathology, heart lesions, respiratory infections, etc., except where such complicating factors were compensated for and operative procedure indicated.

No attention was paid to the sedimentation rate for the first year, it being desired to continue the routine on the service, then later to check back and correlate the operative and pathologic findings with the sedimentation rate and clinical diagnosis. In this manner we sought to compare these various final diagnoses and sedimentation findings to determine the value of the relationship between the two. This first study embraced a series of 545 operative cases with a corresponding group of 1450

sedimentation tests. The operative procedure may be tabulated as follows:

A. Abdominal operations	377
1. Pelvic inflammatory disease	220
2. Fibroids	101
3. Miscellaneous laparotomies	30
4. Appendectomies	19
5. Ectopics	7
B. Cervical operations	51
C. Perineal operations	40
D. Dilatation and curettage	52
E. Bartholinectomies	10
F. Colpotomies	7
G. Examination under anesthesia without operation	8

The revised group of cases which brings the series up to August 1 of this year and includes the first year's group upon which the results were first noted, may be listed as follows:

A. Abdominal operations	Total 1156
1. Pelvic inflammatory disease	633
2. Fibroids	341
3. Miscellaneous laparotomies	83
4. Appendectomies	56
5. Ectopic pregnancies	43
B. Cervical operations	136
C. Perineal operations	115
D. Dilatation and curettage	216
E. Bartholinectomies	23
F. Colpotomies	83
G. Examination under anesthesia	44

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Total 1773

The total number of sedimentation rates during this three-year period is approximately 6,000.

The cases operated for pelvic inflammatory disease included all types and stages of salpingitis, with and without ovarian disease. The majority of these cases were varieties of chronic salpingitis with gross palpable pelvic pathology. A few cases of acute salpingitis were found at operation. It is never our custom to operate in acute cases, therefore, these may be classed as errors in diagnosis. In these few instances the sedimentation rate corresponded with the findings of acute infection.

In our clinic about 60 per cent of the cases came from the colored race and most of the fibromyomas were found in these people. As is true in other clinics, 80 to 85 per cent of these women also had pathologic adnexa, which frequently necessitated the removal of both ovaries, although ovarian tissue was conserved wherever possible. The fibroids showed 10 to 15 per cent of various degenerative changes, and depending upon the extent of degeneration, the sedimentation rate corresponded fairly well with the pathologic findings.

In the miscellaneous laparotomies which included ovarian cysts, exploratory, uterine suspensions, freeing of adhesions, etc., the majority of these cases were opened in addition to perineal work done preceding the laparotomy.

Appendectomies were done on cases mistakenly diagnosed as having adnexal disease.

The ectopic pregnancies revealed 31 ruptured with free blood in the abdominal cavity. Six were diagnosed clinically as tuboovarian abscess, although the sedimentation rate was higher than usually found in that type of pathology. There were 12 cases found to be old ruptured ectopics at the time of operation, this group included the 6 diagnosed as tuboovarian abscess.

The group of cervical operations included 24 advanced cases of cervical carcinoma, of which 7 were treated with radium. There were 12 cases of cervical polyp and the remainder consisted of various stages of cervicitis and endocervicitis, these were treated by cauterization, trachelorrhaphy, low amputation or Sturmdorf operation.

The perineal operations were for the most part anterior and posterior colporrhaphy and perineorrhaphy; there were also 11 patients who had a Watkins interposition operation and 5 patients who had extensive condylomata acumina removed by cautery.

Among curettages, there were 91 done for diagnostic purposes; 15 for polypoid endometritis, and 110 for retained secundines. The large number done for retained secundines is due to the fact that during the past eighteen months, only acute cases have been admitted to the hospital and the largest proportion of these cases have been incomplete abortions with bleeding.

There were 72 cases of frank culdesac abscesses diagnosed and operated upon as such. These were the only patients in the series who had elevated temperatures and white blood cell counts over 10,000. Eleven cases diagnosed as pelvic abscess had colpotomies done but instead of pus, 2 were found to be old ectopics, and 9 were cases of chronic salpingitis with large hydrosalpinx. In all these patients the sedimentation rate was over thirty minutes.

In 44 cases made ready for operation, when taken to the operating room for examination under anesthesia, where the clinical diagnosis was in doubt, were not operated upon because of lack of pelvic pathology. It was interesting to note that in every one of these cases the sedimentation rate was over sixty minutes.

The pathologic and clinical diagnoses of the cases operated upon quite often did not agree, and it was in these especially where a check up on the sedimentation rate which had been done before operation proved very illuminating. The average sedimentation rates as noted in the various types of pelvic pathology in this series are listed in a subsequent table. It is not to be understood that these figures are exact for each condition, nor are they intended to be pathognomonic. On the contrary they are only average figures and the margin of variation between the rates for the various pathologic types is not very exact. The sedimentation rate

is only an additional aid in the general picture when making a diagnosis and not a short cut or an easy method toward exactness.

We consider the sedimentation rate of two hours or over as normal. The average rates for the various conditions are as follows:

Culdesac abscesses	4 to 10 min.
Acute salpingitis	10 to 20 min.
Pyosalpingitis	10 to 20 min.
Subacute salpingitis	20 to 35 min.
Chronic salpingitis	35 to 60 min.
Healed salpingitis	60 min. plus
Fibroid uterus	59 min. plus
Appendicitis subacute and chronic	79 min. plus
Endocervicitis and cervicitis	100 min. plus
Ovarian cyst	122 min. plus
Retained secundines	41 min.
Advanced carcinoma	21 min.
Bartholinitis	90 min. plus
Ectopic pregnancy	40 to 50 min.
Cervical polyp	120 min. plus
Polypoid endometrium	83 min.
Perineal lacerations	120 min. plus
Normal	120 min. plus

It has been interesting to note in our series that in cases of incomplete abortion with definite anemia, the sedimentation rate is more rapid than normal and this finding corresponds with that of other observers. This anemic condition may also explain the lowered sedimentation rate in ruptured ectopic pregnancies.

Of the 1773 cases studied, 1620 showed a definite correlation between the pathologic diagnosis and sedimentation rate. This would give the test an approximate accuracy of about 91.4 per cent. We believe that these figures compare favorably with any laboratory test at our disposal. As compared to this, 1202 cases showed a definite correlation between the white blood count and pathologic diagnosis; this means a percentage of 67.8 per cent accuracy as compared with the sedimentation rate of 91.4 per cent.

There is another laboratory procedure which has attracted considerable attention during the past two or three years which promises, according to some investigators, to surpass the sedimentation test in usefulness. This is known as the filament-nonfilament differential blood count.

Arneth, in 1904, was the first to demonstrate the clinical significance of the various forms of nuclei in the polymorphonuclear neutrophils during various types of infections. He separated these neutrophils into five classes, depending upon the segmentation of their nuclei. In Class 1 he placed the cells with slightly dented nucleus. This made up about 5 per cent of the total in normal individuals. Class 2 cells had two lobules to the nucleus, and comprised 35 per cent of the total. Class 3 had three lobules and totaled 41 per cent; Class 4 made up 17 per cent of the total and had four lobules, while Class 5, which made up the balance of 2 per cent had five or more segmentations. The number of segmentations determined the age of the cell; the greater the number of segmentations, the older the cell. His work, while very complete, proved too complicated for ordinary routine differential counts, but it laid the foundation for the investigation which followed. He proved that an increase in the number of immature cells

represented the response of the myeloid tissue to the stimulation of any infectious agent, and this he termed "the shift to the left." As the infection subsided, the number of immature cells returned to normal and this phenomenon he termed "the shift to the right."

Since Arneth's work, there have been efforts made to simplify the number of classes; to make the test more applicable to clinical use. Schilling, in 1920, published a modification of Arneth's grouping, and placed more emphasis on the change in the staining characteristic of the granules as a result of toxic stimulation and change in size of the cytoplasmic granules.

In 1924, Pour and Krumboor contributed another plan of differentiation in order to simplify former methods. In 1927, Cook and Ponder made valuable contributions to this study of neutrophils. Finally, in 1930, Farley, St. Clair, and Reisinger developed what seems to be a very simple method. They regrouped the five classes of Cook and Ponder into two classes; the first being the same as Class 1 and the second including the other four classes; they termed the first class as "nonfilament" and the second group as "filaments."

Farley, et al., adopted as normal a nonfilament count of 8 to 16 per cent and this is practically agreed to by other observers. The normal of small lymphocytes was placed at 25 to 30 per cent.

Weiss pointed out that during infectious every cellular system of the body is called into action. The bone marrow which supplies the polymorphonuclear neutrophils responds first; and depending upon the severity of the infection, depends the number of nonfilament cells which the marrow contributes. In very acute and severe infections the number of nonfilament cells may be markedly increased. During this time, the eosinophils are usually absent, as are the monocytes, and the lymphocytes have decreased at times to 10 per cent. When the infection subsides the reticuloendothelial system comes into action to replace the neutrophilic stage. The nonfilament cells decrease and there is a definite increase in monocytes with increased numbers of lymphocytes as the lymphatic system becomes active. Thus one should be able to determine and visualize the course of an infection by repeated counts of this type and prognosis could be gauged by the increase or decrease of lymphocytes.

We became interested in this test because of some work done by Reveno and Berent of Detroit and since May, 1932 have been using it routinely on our service. Herein are grouped 538 cases which fall into the following classifications:

Infectious	232
Abortions	167
Miscellaneous	96
Residual	43
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Total	538

In the tabulation of the subheadings of these groups, the average blood count and sedimentation rate, in addition to the filament-nonfilament count has been recorded. The percentage of accuracy has been determined by comparing the three laboratory methods with the pathologic and clinical diagnoses and actually enumerating the number of cases wherein there seems to be no connection between laboratory test and diagnosis.

#### COMMENTS

There was a definite correlation of sedimentation rate and filament-nonfilament count in the cases of infection. This was especially true in the

acute and subacute cases where the tests fairly paralleled each other. The cases of acute exacerbation showed that the sedimentation rate was more accurate in demonstrating the infection than was the filament-nonfilament count. The same situation was found in the study of the pelvic abscesses.

## I. INFECTIONS

	CASES	SEDIMENTATION	FILAMENT	NONFILAMENT	BLOOD COUNT
Acute salpingitis	59	10-20	36-69	10-58	17,000
Subacute salpingitis	28	20-35	40-70	15-32	11,000
Chronic salpingitis	40	35-60	50-70	10-26	9,800
Acute exacerbations	42	12-25	50-78	8-22	12,500
Pelvic abscess	14	6-14	34-65	10-34	16,000
Tuboovarian abscess	26	7-20	44-71	10-38	13,000
Hydrosalpinx	9	8-120	52-66	3-12	7,200
Fibroid and pelvic cellulitis	14	20-48	44-70	4-26	7,800

## II. MISCELLANEOUS

	CASES	SEDIMENTATION	FILAMENT	NONFILAMENT	BLOOD COUNT
Fibroids	34	45-120	40-74	6-20	8,100
Ectopics	16	22-72	43-71	5-24	9,200
Bartholin abscess	4	20-25	50-60	12-16	6,400
Twisted ovarian cyst	3	26	55-57	22-23	11,400
Appendicitis	6	77-90	44-54	10-28	7,550
Uterine polyps with infection	7	13-22	53-64	10-30	12,600
Pregnancy	6	60-90	58-62	4-14	6,800
Perineal cases	14	80-120	54-70	5-15	8,000
Carcinoma of cervix	6	22-30	49-55	11-35	10,500

## III. ABORTIONS

	CASES	SEDIMENTATION	FILAMENT	NONFILAMENT	BLOOD COUNT
Abortion	83	21-120	38-70	4-54	5,000-19,600
Septic abortion	34	7-31	45-60	10-45	18,600
Abortion with anemia	36	19-48	43-70	14-36	13,500
Threatened abortion	14	34-120	46-75	9-16	8,750

## IV. RESIDUAL CASES

	CASES	SEDIMENTATION	FILAMENT	NONFILAMENT	BLOOD COUNT
Cyst of Gaertner's duct	1	120	66	14	4,800
Pyelitis	4	30-60	48-64	14-28	15,400
Meningitis	1	32	50	31	22,100
Uleer of vagina	1	21	48	32	15,800
Rectovaginal fistula	3	22-40	40-53	7-16	8,500
Subinvolved uterus	2	60 plus	64	12	7,600
Ovarian cysts	2	90	56	10	6,100
Fibroid with pregnancy	1	60	54	12	7,300
No pathology	28	60-120	49-71	5-16	7,450

The white blood count varied considerably and was quite frequently not in accord with the pathologic and clinical diagnosis. The filament-nonfilament count apparently varied as to the severity of the infection present, and it was noted that patients with poor resistance had low nonfilament counts. This may account for the relatively low nonfilament count in the protracted cases of culdesac abscess.

The total of nonfilament cells returned to normal more rapidly than the sedimentation rate did after operation or subsidence of the infection and in this way proved to be a very definite aid in prognosis of the case, whereas the sedimentation rate took a longer time in showing improvement of the patient's condition and could not be used for prognostication.

As previously noted, purely from a diagnostic point of view, the sedimentation rate showed an accuracy of 91.4 per cent. The white blood count had an accuracy of 67.8 per cent and of the 538 cases tabulated, 415 demonstrated the accuracy of the filament-nonfilament count, a percentage of 77.2.

The miscellaneous groups again brought out the definite correlation between the sedimentation rate and filament-nonfilament count. Here, too, the white cell count is shown to be a negligible factor. The lowered sedimentation rate in the ectopic pregnancies may be due to the anemia resulting from hemorrhage within the abdomen, for the lowest rates were found in the cases with the greatest hemorrhage. The sedimentation test was rapid in cases of Bartholin abscesses, while the filament-nonfilament count, for some unknown reason, was normal. In cases of appendicitis, the reverse situation was true. These are findings for which we could find no definite explanation. All the cases of uterine polyps were infected as were the cervical carcinomas and showed the proper response on the part of the two tests.

In the group of abortions occurred the most bizarre white blood counts, sedimentation rates, and filament counts. The cases of septic abortion showed rapid sedimentation and increased nonfilament cells as did the severe anemias following abortions. The cases of abortion, both complete and incomplete, without infection had no correlation whatever between the tests or with the condition present. This may be due to the fact that the sudden change in the blood picture brought about by rapid loss of blood, threw the hemopoietic system into such marked activity that all the blood forming tissues were throwing cells into the blood stream. The same condition existed in cases of threatened abortion with acute onset of bleeding which later stopped and where expulsion of fetal structures did not occur.

The group of residual cases is self-explanatory and corresponds with the findings previously noted.

Our conclusions are as follows:

1. (A) The percentage of accuracy of white blood count in these two studies was 67.8 per cent. (B) That of the filament-nonfilament count was

77.2 per cent. (C) The accuracy of the sedimentation rate was 91.4 per cent.

2. There was a definite correlation of the sedimentation rate and filament-nonfilament count in the infectious conditions.

3. The white blood count was not dependable.

4. In our cases of marked anemia the sedimentation rate was more rapid than normal.

5. In the cases of abortion with bleeding there was no correlation between the three tests.

1551 WOODWARD AVENUE.

#### ABSTRACT OF DISCUSSION

DR. HARRY R. HUSTON, DAYTON, OHIO.—During the past two years we have conducted an investigation at the Miami Valley Hospital for the purpose of determining the value of the erythrocyte sedimentation test and the modified Schilling filament-nonfilament polymorphonuclear leucocyte count in surgical diseases. We have found a combination of these two simple laboratory procedures to be of the greatest possible diagnostic and prognostic value, when intelligently combined with the clinical signs and symptoms. The technic of the tests is exceedingly simple and is not time-consuming.

We have found the test to be of particular importance in pelvic inflammatory disease and in acute suppurative abdominal conditions. The filament-nonfilament leucocyte count provides an accurate index of the response of the myelopoietic system to existing inflammation or hemorrhage. The degree of myelopoietic response conforms to the severity of the stimulus, as measured by the appearance of increased numbers of immature polymorphonuclear leucocytes in the peripheral blood stream. In many instances the ordinary white blood cell count, which does not distinguish between mature and immature polymorphonuclear neutrophils, not only fails to yield the desired information, but not infrequently leads to diagnostic confusion. This is particularly true in acute suppurative abdominal disease, in which the total white blood cell count falls within the normal limits or shows but a slight increase. In such cases also the total percentage of polymorphonuclear leucocytes may not be appreciably increased. If it is found, however, that the percentage of immature nonfilament polymorphonuclear neutrophils is appreciably increased, this single additional observation assumes the greatest possible importance. In many instances, we have encountered cases of acute appendicitis in which neither the clinical signs nor the ordinary white blood cell count provided convincing diagnostic evidence, but in which the percentage of immature polymorphonuclear leucocytes was well above the normal level. This finding is of particular importance if repeated blood counts are carried out and the number of immature cells shows a progressive increase. Such evidence indicates that suppuration is present.

In the differential diagnosis of uncomplicated benign pelvic neoplasms and pelvic inflammatory disease the information provided by these tests has been invariably conclusive in our experience.

DR. LAWRENCE M. RANDALL, ROCHESTER, MINN.—Dr. Yates' paper serves to emphasize further the importance of the correlation between the clinical and laboratory data. This is brought out in the paper by the statement that 91 per cent of his sedimentation tests were accurate when the history and clinical findings were taken into consideration. If one employs this test as a short-cut to diagnosis it is likely to get us into trouble.

It has been pointed out by Westergren that the sedimentation test is really a test of the sedimentation reaction of the individual; that it is nonspecific and is not necessarily a help to us in localizing the disease process. We have felt that the sedimenta-



tion reaction in conjunction with the other data obtainable concerning the patient will allow us to make a final diagnosis in the first place, and in the second place, after the reaction is determined repeatedly on the same patient, it permits us to judge results in treatment and to aid in determining the time for operative interference.

DR. ALBERT MATHIEU, PORTLAND, OREGON.—After a consideration of between eighteen and twenty thousand estimations of the rate of sedimentation of red blood cells, we have arrived at the following conclusions:

1. The sedimentation rate is increased in the blood of patients who have in their bodies conditions of acute inflammation, marked cellular proliferation, or hemorrhage under pressure.

2. Lobar pneumonia and acute miliary tuberculosis give the highest rates followed closely by acute gonorrheal salpingitis.

3. Infection is not necessary to a rapid rate as carcinoma and pregnancy both cause it to be increased.

4. A routine red cell sedimentation rate in conjunction with every physical examination will repay the gynecologist or obstetrician who of necessity is not as complete in his general examination as the internist. Often the sedimentation rate will be increased without any explainable cause and this increase in rate is the warning that some hidden trouble must be sought. In our experience, the sedimentation rate has been of far more value than the leucocyte count because at times even though there was no leucocytosis and the patient's complaints were more or less vague, the sedimentation rate acted as an unmistakable sign that we were overlooking something.

One such instance I will mention as an illustration, giving only the barest details. A woman three months pregnant, normal in every way as far as could be determined and with absolutely no complaint except pregnancy, gave an extremely rapid sedimentation rate: 50/96. Her urine and leucocyte counts were constantly negative and normal respectively but repeated sedimentation rates were increasingly rapid. After search and study a pyelonephritis with nephrolithiasis was found. Had it not been for attention to the sedimentation rate this would have been missed because it presented absolutely no symptoms.

DR. FREDERICK H. FALLS, CHICAGO, ILL.—We have been studying the sedimentation test at the University of Illinois from a different angle. We did careful tests on a series of 208 gynecologic cases of various types. We then prepared these patients for operation according to the usual method of observing the clinical condition of the patient. When the temperature remained normal for a week or ten days and the leucocyte count was below 10,000, we operated whether or not operation was contraindicated according to the sedimentation test. After operation we checked the sedimentation rate against the number of hospital days and postoperative morbidity and mortality. There was no appreciable difference in these respects between cases with high or low sedimentation rates. We feel therefore that a great deal of time will be saved to the patient if a rapid sedimentation rate be disregarded when it does not agree with the clinical findings.

DR. YATES, (Closing).—All I wish to say in conclusion is that from our experience of 1700 cases the sedimentation time and nonfilament estimation are of very definite prognostic and diagnostic significance, and we have become more and more skeptical about the simple, old fashioned white blood count. As I said in the paper, this is not a short-cut to diagnosis, but it is a distinct aid in the study of infectious processes and a prognostic guide. I do not wish to put this as an ultimatum in the way of determining our position in a given case but, with Dr. Falls, I certainly agree that as clinicians we must think clinically of a patient irrespective of any type of instruments of precision or laboratory findings. We find more and more as we study our clinical symptoms that after all the basis of our activity should be determined by them.

# THE RELATIONSHIP BETWEEN EXOGENOUS THROAT STREPTOCOCCI AND PUERPERAL INFECTIONS\*

FOSTER S. KELLOGG, M.D., AND ARTHUR T. HERTIG, M.D.,  
BOSTON, MASS.

*(From Departments of Obstetrics and Pathology, Harvard Medical School)*

DURING the "respiratory season" in 1911-1912, a very severe and disastrous epidemic of puerperal sepsis occurred in a hospital in Boston. The most striking single fact of this epidemic was that a certain number of the cases, fatal as well as nonfatal, and regardless of whether examined at or near delivery, occurred late in the puerperium. Some were as late as the ninth, tenth, and eleventh day, while occasional patients were up and ready for discharge. This epidemic was competently written up and was considered to be primarily throat borne. Permission to publish was withheld because, one presumes, of undesired publicity. That such was the case seems in retrospect a great pity and a great responsibility as one contemplates the possible educational results of such a published study toward the reduction of puerperal mortality in the past twenty years.

In contrast, in 1927 when a serious outbreak of puerperal infection took place at the Sloane Hospital in New York, Meleny and Stevens made a careful investigation, with the result that they "failed to reveal any probable cause except air contamination (i. e. contact contamination through the air, by nasopharyngeal droplets) by carriers among the medical and nursing personnel and as a result they recommended the wearing of masks by all who enter the delivery room in hospitals."

To show that this final sentence is right as far as it goes but does not go as far as it should is the purpose of this paper.

On the evening of December 17, 1931, one of us (F. S. K.) was asked to see a patient in consultation in a well-equipped general hospital with a small maternity wing. An epidemic of puerperal sepsis was found; one patient had died the day before and one was dying. Of ten women consecutively delivered from November 19, 1931, to December 7, 1931, nine ran febrile temperatures to a greater or less extent in the puerperium. Two of these died and positive cultures of hemolytic streptococci were obtained from the blood stream and uterine cavity. Without reiterating what may be readily seen on the charts, four facts are noteworthy: (1) On the whole the temperature rises are later than one expects in infection at delivery. (2) Several different men delivered the patients. (3) The symptoms were largely peritoneal. (4) The prostration was on the whole out of proportion to the elevations shown.

\*Read at the Forty-fifth Annual Meeting of the American Association of Obstetricians, Gynecologists and Abdominal Surgeons, French Lick Springs, Ind., September 12, 13, and 14, 1932.

Having seen the patient in question in consultation (No. 7) and given a good prognosis on the basis that she seemed to be localizing in the left vault, we discussed the situation. It was agreed to keep the ward shut which had been closed since December 5, send such patients to their homes as would probably not need transfusion or surgery, and place such patients as remained in a large available open ward with the windows open and shut off from the rest of the hospital. A guess was made that diligent search would reveal a throat carrier.

Much admiration for the honest manner in which the staff was meeting its responsibilities has increased with their readiness to permit this report. It is more impressive in contrast to previous experience.

Two days later information was forwarded that a culture of hemolytic streptococci had been obtained from the throat of a nurse in contact with all the patients.

Excerpts from a final letter from the physician in charge show the chronological relationship of this contact and are here quoted. "The nurse was on duty at night in the maternity ward. Due to the fact that it is a small unit there is only one nurse on at night except when deliveries occur. Therefore she came in contact with every patient in the ward except two that had specials. This nurse was complaining of sore throat and slight malaise about November 25. This nurse was admitted sick to the medical service November 27 and was off duty for three days coming back on the thirtieth. Her throat was cultured but unfortunately through some oversight the report came back 'Negative for diphtheria.' She was most unfortunately sent back to the maternity ward."

Briefly summarized in the letter the course and end-results were as follows:

5 Patients had a rather mild course and went home well.

2 Patients died.

1 Patient sent home with temperature, bled, returned, transfused, well.

1 Patient ran a septic temperature for a long time, was sent home and an abscess opened over Poupart's ligament on left. Is well now.

1 Patient ran a septic course, went home after six days of normal temperature on December 25, 1931. She remained temperature free until March 25, 1932, and at that time was running a temperature of 102°-103° F. with intestinal symptoms, whether due to the old infection or to grippe was not then determined. This patient recovered after six weeks without definite diagnosis.

Thus we have in this small epidemic a 90 per cent morbidity, half mild, half severe, and a death rate of about 20 per cent.

The letter continues, "As I told you the idea of streptococcus did not enter my head until after closing the ward. On December 7, before any of the patients had become dangerously sick, Mrs. Z. developed a scarlet rash. She had had scarlet fever a few years before. On this day the local board of health was called in but agreed with a diagnosis of grippe and offered nothing in the way of help.

"There were two blood cultures positive for hemolytic streptococcus and a similar organism was obtained from the inside of each of these patients' uterus. Both died. The throat cultures were several times negative on all the patients that had the

disease, including the two that died. About December 15 the State Board of Health was called in. Cultures were made from the air with Petri dishes which were negative, and throat cultures from the nurses, doctors, attendants, etc., were taken. All were negative except this one night nurse. They were negative three days later."

So is rounded out a clear cut picture showing possible results of throat borne hemolytic streptococci to parturient women in a well regulated hospital. It demonstrates that hospital sepsis is not a thing of the past entirely, and that our technic for the protection of our patients needs improvement.

The explanation of the source of this catastrophe is clinically satisfactory, but from a bacteriologic point of view leaves something to be desired. We are able to supply this additional data in part from another experience occurring within three months of the above, in an institution for which one of us (F. S. K.) is responsible. It was checked by complete bacteriologic studies by one of us (A. T. H.) in a precisely similar single instance occurring in still another hospital at about this time.

Our second experience came from two patients delivered at the Florence Crittenton Hospital in Boston.

A summary of these cases is as follows:

CASE 1.—Primipara. Low Forceps. Death on the tenth day, postpartum after late transfer to Boston City Hospital and "Terminal transfusion."

Diagnosis: *Streptococcus septicemia* (puerperal). Probable peritonitis.

CASE 2.—Primipara. Face presentation, internal podalic version. Recovery on fifty-seventh day, postpartum after early transfer to Boston Lying-In Hospital (sixty hours) and early repeated transfusion.

Diagnosis: *Streptococcus septicemia* (puerperal).

Knowledge of the death of the first patient came to the chief of the Florence Crittenton staff through accidental information from a member of the City Hospital surgical staff. This fact goes to show that even now the potential seriousness of a single case of puerperal sepsis to other patients in an institution supposed to be "well regulated" is not appreciated by otherwise well trained doctors and nurses. Early the following morning at the hospital it was rather casually mentioned that "another patient had a temperature" the night before. This patient had a temperature of 104° and a pulse of 130 in the morning and was the picture of a full-blown puerperal streptococcus sepsis. Immediately permission was asked and granted to transfer the patient to the Boston Lying-In Hospital. This transfer was immediately made. At the risk of seeming trite such a transfer accomplishes the following objects: (1) It rids the small institution with its untrained pupil nurses and poor isolation facilities of a menace to the other patients. (2) It puts the patient into an institution where proper isolation facilities and nursing personnel (i. e. septic floor both ward and single rooms with special nurses) are safeguards to the rest of the institution. (3) It places the patient in a position to have constant medical attention, bacteriologic study, and high grade nursing. In this connection we believe that, aside from good nurs-

ing, fresh air, and assured rest (a matter of supreme importance, often neglected), frequent transfusion, checked by red counts every other day, is our only therapeutic measure. We further believe that such transfusions should be begun very early in the disease and not used as a late or last resort. This implies available donors in quantity and a large medical personnel since double team transfusion is highly desirable in the interests of these donors. For example it is clear in retrospect at least, that Case 1 should have been transferred and transfused long before she was. The fact that transfer "within the hour" of the second patient appeared to surprise the personnel at the institution, emphasizes that the subject is a blind spot to too many persons otherwise well trained in maternity care. Had the first patient been transferred early and a proper investigation undertaken it is unlikely that we would have had a Case 2, while in the light of the outcome of the second case it is possible the first might have recovered. Until the significance of this is grasped by all connected with maternity care, unnecessary deaths will take place periodically.

Following the transfer of Case 2 a brief survey of the Florence Crittenton Home was undertaken by one of us (A. T. H.) in an attempt to uncover any factors which may have had an epidemiologic bearing on the septic outbreak. At no time were there any demonstrable contacts between either patient except in the prenatal wards where both spent some time prior to delivery. During this period neither showed symptoms of any sort. During the four days after delivery, the first patient occupied a bed in the eight bed postpartum ward. On the third day she had an elevation of temperature up to 103.6°. She then remained isolated for five days in a single room. At the end of this period she was sent to a large general hospital where she died twenty-four hours later, or ten days after delivery, of septicemia and probably generalized peritonitis. No autopsy was done but a pure culture of alpha prime hemolytic streptococcus (so reported by the bacteriologist) was isolated from the blood stream prior to death. Unfortunately this strain was not obtainable at the time this investigation was undertaken.

Both patients were delivered by the same personnel, including the visiting obstetrician, house officer, supervisor, and nurses. Only the operators were masked during the delivery. A feature of interest was the fact that both patients occupied the same bed in the postpartum ward, although they were delivered eleven days apart. During the last seven days of this period the bed was empty and was aired on the sun porch together with the mattress and blankets. All bedding, with the exception of the latter articles, was sterilized. It is doubtful if hemolytic streptococci could have remained viable under those conditions either on the bed or in the bedding. Granting that there might have been some etiologic relationship between the first and second case, the former has yet to be explained.

The second patient, after experiencing a chill with elevation of temperature on the second day, was sent to the Boston Lying-In Hospital where she ran a septic course for many weeks but finally recovered. During her stay, hemolytic streptococci of a type similar morphologically to those isolated from the first patient were isolated from her lochia and blood stream.

Because of the lack of demonstrable etiologic factor in either case, throat cultures were taken from all persons who had been in contact with either patient. These included the visiting obstetrician, house officer, the supervisor, and seven duty nurses. All cultures were negative for hemolytic streptococci except those from two nurses which were strongly positive. Each yielded a culturally different strain of hemolytic streptococcus. That from the night nurse possessed a relatively large clear colony with a faint but distinct zone of hemolysis (as did the two strains from the patients), while the other strain was of the usual beta type with small, clear colonies, and a wide, prominent zone of hemolysis. Both strains in broth were similar morphologically, possessing chains averaging eight to twelve organisms in length. It is interesting to note that from both patients culturally similar strains of hemolytic streptococci were obtained which corresponded to the type isolated from the throat of the night nurse. Incidentally the latter was suffering from symptoms of a mild upper respiratory infection during the septic outbreak. Rabbits were immunized by injection of these strains in an attempt to determine by cross agglutination what, if any, relationship there existed between the throat organisms and the one isolated from the second patient. The latter strain continually killed rabbits so that no immune serum was obtained for typing.

Regardless of the fact that a positive etiologic relationship between one or the other of the throat strains and the second case of puerperal sepsis was not proved, such a relationship has been definitely established in one case coming within the experience of one of us (A. T. H.). The patient, a para ii, delivered in a private hospital by an easy Scanzoni maneuver ran a perfectly normal postpartum course for the first seventy-two hours. At this time she had a chill followed by elevation of temperature and evidence of a spreading peritonitis. A pure culture of hemolytic streptococcus was isolated from the lochia on the fourth day, and from the peritoneal cavity, at autopsy, on the seventh postpartum day. Cultures were made from the throats of all persons coming in contact with this patient, in addition to one from the throat of the patient herself. The only positive culture obtained was from the throat of the patient's own private nurse. Subsequent typing of Dr. J. H. Mueller of the Department of Bacteriology at the Harvard Medical School showed the patient's strain to be apparently identical with that isolated from the throat of the nurse.

On transfer of patient 2 the following standing orders for personnel

were immediately posted, put into effect and the superintendent made responsible for their maintenance.

#### RULES FOR NURSES AT THE FLORENCE CRITTENTON HOSPITAL

1. Graduate and pupil nurses shall be masked and capped at all times when in contact with patients as long as the patient is on the hospital floor.

2. Failure of a nurse to report a cold or sore throat to the head nurse shall be followed by summary dismissal without credit if discovered.

#### RULE TO HEAD NURSE REGARDING SORE THROATS AND COLDS

Absolute masking must be insisted upon, and breakers of this rule punished.

A loose mask around the neck is no protection.

On receiving a report from a nurse that she has a sore throat or cold, the nurse shall be isolated in her own room and four hour temperatures taken, by the head nurse or acting head nurse, herself masked. The head nurse or acting head nurse shall then scrub as for an operation, after each contact. The person servicing the nurse shall not be a pregnant inmate and shall not service pregnant or delivered inmates, unless she is a graduate nurse in which case she must "Scrub up" ten clock minutes after each contact. This event should be reported to the superintendent or the acting superintendent who will make provision for cultures to be taken. The nurse shall not be allowed out of her room until permission is granted in each instance by the chief of staff after consultation with the superintendent and report of cultures has been obtained.

It is expected that the head nurse will apply this rule to herself as well. The infected nurse shall be allowed back at work in the hospital again only with the specific permission of the chief of staff.

No perineal ice bags shall be used under any circumstances in the Florence Crittenton Hospital.

#### RULE FOR RESIDENT AT THE FLORENCE CRITTENTON HOSPITAL

He shall report all temperatures of 100° or over to the staff man, who is supposed to see such patients within six hours. If the staff man does not respond within this time he shall report the temperature to the chief of staff.

He shall be masked and capped during all contact with patients before, during and after labor.

It seems reasonable to draw the following conclusions from the above:

1. That nasopharyngeal carriers of hemolytic streptococci (and perhaps other organisms) are a most dangerous source of frequently fatal sepsis to women in childbirth from the moment labor begins (and possibly before) to the end of the puerperium (at present an unassignable date but at least fourteen days after delivery).

2. That "silent carriers" are potentially as dangerous as persons acutely sick with temperatures, save for less likelihood of coughing or sneezing, although usually a history of some acute exacerbation in the not distant past may be obtained from the carrier.

3. That perineal contacts are presumably the most frequent method of transmission; either by coughing, sneezing, or talking with the patient during perineal precautions or by incomplete manual asepsis after self infection of the hands by the carrier, as by the use of a handkerchief; but that for the present other less direct methods must be assumed, and guarded against.

4. Hence that every carrier is a source of danger and must be eliminated or be masked adequately at all stages of labor and the puerperium and be absolutely trained and trustworthy about digital asepsis.

5. That since pupil nurses are untrained and unhabited to conscientious digital asepsis, it is a wise precaution to culture each one on entrance to a maternity hospital and to eliminate each one temporarily until the throat is negative for hemolytic streptococci.

6. That other personnel, i. e., doctors and graduate nurses trained in asepsis, following rules akin to those given above, will in all probability not prove a hazard to patients.

7. That the question of ward attendants, especially those serving food must be carefully considered.

8. That a single case of puerperal sepsis in an institution calls for immediate rigid investigation and drastic measures based on this to limit spread.

We wish to express our gratitude to the unnamed collaborators in this paper without whose cooperation and sanction it could not have been written or published.

19 BAY STATE ROAD.

#### ABSTRACT OF DISCUSSION

DR. EDWARD SPEIDEL, LOUISVILLE, Ky.—With all the precautions mentioned in protecting our patients from this kind of infection we lose sight of the greatest menace of all, the visiting public that enters the hospital. Unless we have an opportunity to limit this nuisance of excessive visiting in hospitals, especially in maternity hospitals, I fear that all of the precautions mentioned in the paper will be nullified.

There is another item that should be considered. Fever may occur in patients where the delivery was conducted without any examination, or in such manner that infection could not have been introduced. In many of those cases the patient probably had a gonorrhea in the cervix and in the course of the puerperium these organisms became very virulent and caused elevation of temperature.

DR. BETHEL SOLOMONS, DUBLIN, IRELAND.—In our institution we are not wearing masks and are not having trouble. I have taken some series of throat swabs when there were no infections and got exactly the same results as when there were infections. You may say, but why not take that little extra precaution and wear masks? I have been in hospitals in various places where masks were worn, the masks being sucked in and covered with saliva. Laehlan Grant, medical officer of health in Argyle, Scotland, has written a very fine paper, condemning masks on account of the moisture that collects.

DR. KELLOGG (closing).—Regarding masks, there is no question that the present mask in use is inadequate and we are working, as some others are, to get a more satisfactory mask. Sepsis is a relative thing anyway. If a mask is worn in a laparotomy, and I take it most people do this, it seems rather queer not to mask over an open wound in a perineum.

In discussion of almost any obstetric problem, there always arises in my mind a suspicion that local conditions in different places vary. Now the hemolytic streptococcus of Dublin and that of Boston may be qualitatively or quantitatively different. When, for example, we reported 25 per cent mortality in eclampsia, and others say that they would be glad to come to Boston and teach us how to lower our mortality, we begin to suspect that the type of eclampsia may differ in different regions. We do have in New England an extremely virulent and a very pernicious hemolytic streptococcus each season, which appears to cause a good many clean cases each year to end fatally.



# INJURY TO URETERS INCLUDING ACCIDENTAL LIGATION DURING PELVIC OPERATIONS\*

QUITMAN U. NEWELL, M.D., F.A.C.S., ST. LOUIS, MO.

*(From the Department of Obstetrics and Gynecology, Washington University Medical School and Barnes Hospital)*

I WAS prompted to make a study of this subject, because recently I performed a complete abdominal hysterectomy for carcinoma of the fundus uteri, and thirty-six hours after operation, the patient died from an acute dilatation of the heart. The autopsy showed, in addition to the heart condition, that I had ligated the left ureter about 5 cm. from the bladder. The right ureter was in normal condition, although the patient did not pass any urine following the operation. I desire to report the history of the patient in question, also other cases in which the ureters were either ligated or injured during pelvic operations in the Gynecological Service of Barnes Hospital, from Jan. 1, 1915, to July 1, 1932.

From Jan. 1, 1915, to July 1, 1932, in the Gynecological Service of Barnes Hospital, 1784 hysterectomies were performed for various reasons. Of this number 519 were complete abdominal hysterectomies, 63 were complete vaginal hysterectomies and 1202 were abdominal supravaginal hysterectomies. During the course of these operations, one or both ureter were knowingly injured by clamping, cutting, tying or interfering with the circulation in some manner in eight cases. This is an unusually small number of injuries as compared to the number of hysterectomies performed. I am sure one ureter is occasionally ligated and the condition is unrecognized and the kidney on the corresponding side dies before the ligature around the ureter is absorbed.

During the postoperative course, there are no definite symptoms to show that only one kidney is functioning. Of course, if both ureters are ligated, the patient has an anuria and by cystoscopic examination the diagnosis is easily established.

Most gynecologists regard operative injury of the ureter as exceptional and nearly all are in accord in believing unilateral injury fairly common and bilateral injury exceedingly rare. They describe ureteral injury as the most common accident in pelvic work.

## CASE REPORTS

CASE 1.—Mrs. A. P. R., aged sixty-seven years. Hospital No. 22954. Admitted Dec. 26, 1929, for vaginal bleeding. A very large obese patient weighing 198 pounds, with a chronic myocarditis and hypertension of 176 over 98. She presented a carcinoma of fundus uteri. A medical consultant classified her a fair operative risk. An abdominal operation was considered the treatment of choice. This was preceded by

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diagnostic dilatation and curettage, and the laboratory reported adenocarcinoma of the fundus uteri. On Jan. 4, 1930, at time of laparotomy, it was noted that patient had two uteri and two cervixes. This was not diagnosed before operation as the cervix on the right side had not been seen during speculum examination. However, a lot of scar tissue was found extending the entire length of the anterior vaginal wall. Probably the result of extensive vaginal lacerations during childbirth. A small mass was palpable in the right side of pelvis in apposition to a normal uterus which was felt in a forward position. The mass was thought to be a prolapsed adnexa or some parametrial infiltration. There was a band of peritoneum extending forward from the sigmoid to the central part of the top of the bladder. It was ligated and severed. The two uteri were fully developed, the one on the left side was slightly larger than the one on the right. They were attached to each other at about the internal os and continued into the vagina. Attached to each fundus was one tube and one ovary. Complete hysterectomy with removal of both tubes and both ovaries were performed in the usual manner. All the clamped pedicles were ligated, the tuboovarian and upper broad ligament pedicles were ligated before the uteri were removed. There was insufficient bladder peritoneum to cover the ligated pedicles so some raw surfaces were left exposed. At no time during the operation were the ureters visible. The appendix was not removed. Abdomen closed in routine manner and retention catheter placed in position. The operation was fairly difficult due to excessive fat in the pelvis.

*Postoperative Course.*—Patient returned to ward in fair condition and immediately was given 1500 c.c. normal saline solution subcutaneously and 500 c.c. 10 per cent glucose solution intravenously. Six hours after operation patient was fully conscious and had no unusual complaint. The blood pressure was 152 over 98. No urine had passed per catheter. She had a fairly comfortable night and next morning seemed to be in good condition, no unusual abdominal pain, no distention, no pain over either kidney region. No urine had been obtained per catheter since operation twenty hours previous. It was then realized that anuria had developed. Additional saline and glucose were given and fluids were forced by mouth along with treatment to stimulate diuresis. Thirty hours after operation patient began showing signs of uremia with evidence of myocardial failure. No urine had passed up to this time. Thirty-six hours after operation patient expired. An autopsy was performed and the cause of death was given as acute dilatation of heart, chronic myocarditis, chronic nephritis and arteriosclerosis. During the course of the autopsy it was found that the left ureter was ligated about 5 cm. from the bladder. The right ureter was in good condition. There was no marked difference in either of the kidneys. They did not show evidence of hydronephrosis, etc., as you would expect in case of obstructed ureters. No doubt, the anuria was the result of constitutional causes and not the result of ligation of the left ureter.

CASE 2.—Mrs. A. H., aged thirty-five years. Hospital No. 818. On May 11, 1916, she was operated upon for myoma of the uterus. A supravaginal hysterectomy with double salpingoophorectomy were performed. The postoperative course was stormy and on the fourth postoperative day patient showed signs of uremia. No urine had been obtained since operation; cystoscopic examination revealed both ureters blocked a short distance from the bladder. It was then decided to open the abdomen and attempt to deligate the ligated ureters. A description of the operation is as follows: Abdomen opened through old incision. Much fibrin and clear serous fluid were present. The right kidney was enlarged with the ureter distended to about the size of small finger. About 2 cm. below the pelvic brim a ligature was found around it, a second ligature was around the ureter at about the position of the internal os of the uterus. The ligatures were cut and the ureter freed. Left ureter apparently was not definitely ligated but edematous and enlarged. The stumps of the cut adnexa and ligaments of the uterus had been drawn over the ureter during previous operation.

These sutures were cut and the ureters freed. Abdomen closed hurriedly with drainage. Patient returned to ward in poor condition. She died from general peritonitis thirteen days after the operation. There is no history of any passage of urine following operation.

CASE 3.—Mrs. B. F., aged sixty-six years. Hospital No. 2031. On Sept. 22, 1919, was operated upon for cancer of cervix uteri. A complete vaginal hysterectomy and double salpingo-oophorectomy were performed. The postoperative course was stormy and thirty days after operation urine dribbled from the vagina. Cystoscopic examination revealed a left ureterovaginal fistula. She was discharged from hospital after thirty days with ureterovaginal fistula present. She reentered the hospital later and reported the dribbling of urine from the vagina ceased after eight months. Cystoscopic examination at this time revealed no function of left ureter with a dead kidney. Right kidney in good condition. Patient also had diabetes mellitus.

CASE 4.—Mrs. B. S., aged forty-three years. Hospital No. 2206. On April 16, 1920, was operated upon for retrodisplacement of uterus, chronic cervicitis and cystoma of right ovary. A complete abdominal hysterectomy with double salpingo-oophorectomy were performed. The postoperative course was stormy. Twelve days after operation a rectovaginal fistula and a ureterovaginal fistula were noted. She was discharged from hospital twenty-eight days after operation with ureterovaginal fistula present. The rectovaginal fistula closed spontaneously. Patient reentered the hospital two months later complaining of dribbling urine from vagina. Cystoscopic examination revealed no function from right ureter into bladder. The left catheter passed easily and function was normal. The right kidney was large and filled with pus. A right nephrectomy was performed. The postoperative course was uneventful, and patient was discharged from hospital twenty days after operation.

CASE 5.—Mrs. M. W., aged forty-four years. Hospital No. 2260. On June 8, 1920, she was operated upon for myoma of uterus (large). A complete abdominal hysterectomy and double salpingo-oophorectomy were performed. The postoperative course was stormy. Four days after operation a ureterovaginal fistula developed which persisted throughout hospitalization. She was discharged from hospital forty days after operation with ureterovaginal fistula present. Cystoscopic examination made before discharge from hospital revealed bladder normal: right catheter passed easily to kidney. Left catheter met obstruction 3 cm. from bladder. Patient advised to go home and come back later for treatment for ureterovaginal fistula. She never returned to hospital and nothing further was heard from her.

CASE 6.—Mrs. W. M., aged thirty-nine years. Hospital No. 10903. On July 14, 1921, she was operated upon for early carcinoma of cervix uteri. A complete hysterectomy with double salpingo-oophorectomy were performed. During the operation both ureters were isolated and apparently not injured. The postoperative course was moderately stormy. Eight days after operation a ureterovaginal fistula developed. She was discharged from hospital thirty-four days after operation with ureterovaginal fistula present. Patient reentered the hospital four months later, at which time cystoscopic examination revealed normal bladder. Left catheter passed easily to kidney. Right catheter met obstruction  $2\frac{1}{2}$  cm. from bladder. She was discharged from hospital to return two months later for operation on ureterovaginal fistula. She reentered the hospital at the appointed time and the operation was carried through, making a right inguinal incision. The ureter was isolated and found greatly distended and led from the kidney to the vaginal vault. It was freed and transplanted into the bladder without tension. Three days after operation urine flowed from the abdominal incision and it was plainly seen that an abdominoureteral fistula had formed. After thirty days urine ceased to flow from the wound and it healed nicely. Patient was discharged from hospital without doing a cystoscopic examination. January 1, 1931, nine and one-half years after first operation cysto-

scopic examination and x-ray plate showed a dead right kidney. Function of left kidney normal.

CASE 7.—Mrs. A. C., aged twenty-nine years. Hospital No. 16862. On Sept. 4, 1928, she was operated upon for myoma of uterus. A supravaginal hysterectomy with double salpingoophorectomy were performed. During the course of the operation the right ureter was severed near the bladder. It was immediately transplanted into the bladder without tension. The postoperative course was stormy and the patient complained of great pain in right kidney region. No fistula developed. A few days after operation it was discovered patient had a right pyonephrosis and the transplanted ureter was not functioning. Thirty days after operation the right kidney was removed. She had an uneventful postoperative course and was discharged from the hospital nineteen days later in excellent condition.

CASE 8.—Mrs. D. C., aged forty-nine years. Hospital No. 30848. On August 13, 1931, she was operated upon for chronic subinvolution of uterus and chronic salpingitis. A complete abdominal hysterectomy with double salpingoophorectomy were performed. The postoperative course was markedly febrile. Patient discharged from hospital Aug. 31, 1931, eighteen days after operation with some temperature present. On the seventeenth postoperative day dribbling of urine was noticed coming from the vagina. She was discharged with this condition present. Two months later patient began having severe pain in the lower abdomen, chills, and temperature. She urinated often and passed small quantities of urine. On Oct. 22, 1931, she returned to Barnes Hospital complaining of urine passing from vagina. Patient admitted to the Genitourinary Service and a diagnosis of ureterovaginal fistula was made. Cystoscopic examination revealed a good left kidney and ureter. The right catheter met an obstruction about 2 cm. from the bladder. On Nov. 11, 1931, a right nephrectomy was performed. The kidney was enlarged twice its normal size and the pathologic report showed an acute hydronephrosis with chronic pyogenic nephritis. Patient had an uneventful postoperative course and was discharged from the hospital Nov. 27, 1931, in excellent condition.

Much of the literature dealing with ureteral injury and ligation is in the form of case reports. However, in the past few years the subject is receiving more attention and a few investigators have attempted to correlate the cases and large series have been reported. P. Brooke Bland has collected 441 cases, 361 were unilateral and 81 bilateral injuries or ligations. Of these Leon Herman reported 24 cases, all bilateral. Barney has reported 62 cases including 32 presented by Sampson in 1902, and Oeconomos has collected a series of 159 cases. The additional 196 cases were from several investigators in various parts of the country. Forty-two surgeons reported 125 cases ranging from one to eight. H. Kayser reported the cases in the clinic of Professor Franz, Charite Hospital, Berlin, for five-year period. He listed 29 instances of injury or ligation of the ureters and quotes Wertheim as having had 49 injuries among 500 hysterectomies for uterine carcinoma. T. S. Burr refers to 630 hysterectomies for cancer of the uterus in which a single ureter was injured 13 times and both ureters once.

From a study of the cases reported, it is evident the greatest percentage of ureteral injuries followed radical hysterectomies for uterine carcinoma and the most common sequelae were ureterovaginal fistulae.

Most of the textbooks in gynecology outline the treatment for ureteral

fistulae following injury in which the ureter may be cut or crushed with a clamp, or the blood supply interfered with to such an extent that necrosis and sloughing follows. Very little is said about the treatment when one or both ureters are ligated.

From an analytical study of the eight cases reported in this presentation, together with a careful consideration of the several hundred cases reported in the literature by numerous excellent investigators, I desire to offer an opinion as to what method of treatment seems most suitable for handling this most perplexing problem. In presenting this, I should like to sound the warning note of prophylaxis. I am quite sure many cases of ureteral injury can be avoided if modern technic is followed when performing an extensive pelvic operation. I am sure every gynecologist is conscious of the fact the ureters may be injured during the course of almost any pelvic operation. The radical abdominal hysterectomy operation for uterine carcinoma tops the list of ureteral injuries, vaginal hysterectomy next, then complete abdominal hysterectomy for myoma, etc. Therefore, when performing any of these operations, or any other extensive pelvic operation, I would suggest as a prophylactic measure, that the ureters be isolated according to the familiar technic. As an additional safeguard catheters may be inserted into the ureters before starting the operation, as suggested by Kelly many years ago.

*At the Time of Operation.*—If it is discovered that one or both ureters have been ligated, the proper treatment is to deligate as soon as the condition is recognized. Ordinarily, the ligature around the ureter is not sufficient to cause permanent injury. If one or both ureters have been severed, a ureteroureteral anastomosis should be performed by one of the various accepted methods. Transplanting the ureter into the bladder is only fairly satisfactory, as the contraction of the wall of the bladder constricts the ureter, eventually causing a pyonephrosis and death of the kidney. Some few successful cases of ureteral transplant into bladder have been reported. Of course, if the patient is in bad shape and only one ureter is damaged, a ligation may be done, which will cause death of the kidney. This is a sacrificial operation and only considered as a last resort. The ureteroureteral anastomosis operation is the one of choice.

Peterson in an analysis of 72 cases of ureteroureteral anastomosis has shown it is usually successful, claiming that the different methods are equally effective in the hands of different operators. He found in 29 cases of the end to end operation, leakage occurred in 9. In 25 end in end operations leakage occurred in 5, and in 15 end in side operations leakage occurred in only 2. As to final results one must consider in all these operations that in a small percentage of the cases there will be contraction of the scar at the site of the ureteral repair with complete occlusion of the ureter and death of the kidney on that side, but as a whole this is negligible.

A. H. Curtis has described a simple and practical method of end to end ureteral anastomosis. A ureteral catheter is passed into the cut ureter and the lower end brought out through the bladder and urethra, the two ends of the ureter are sutured together, taking care not to penetrate the lumen of the ureter with the sutures. A second ureteral catheter is placed into the ureter above the point of the anastomosis through a small slit and passed up to the pelvis of the kidney so as to divert the passage of the urine away from the regular course. This catheter is brought out through a stab wound in the flank. After ten days both catheters are removed. Warner S. Bump and Stanley M. Crowe of the Gynecological Department of Northwestern University Medical School worked out the technic on dogs and the operation was successfully performed six times. In not a single case did a urinary tract infection take place and necropsy of the animals showed perfect function of ureter and kidney. Curtis has performed the operation once upon a woman with complete success. He has made no other attempts.

Such a technic is both practical and simple. Heretofore, many failures of end to end anastomosis have been due largely to infection following the leakage of urine around the end to end contact, causing peritonitis or adhesions about the ureter, later resulting in contraction of the ureter at the site of the anastomosis, hydroureter and death of the kidney. With the use of the ureteral catheter as a splint, the operation need not necessarily be water tight. Coaptation of the two ends over the catheter with enough fine sutures to make them fast is all that is necessary, as the catheter which has been passed up to the pelvis of the kidney and brought out through the flank reroutes the urine and thus allows epithelization of the ends of the severed ureter to take place.

If it is discovered that the ureter has been crushed by a clamp, the injury should be carefully examined and if it is determined to be severe, end to end anastomosis should be done in order to prevent a ureterovaginal or ureteroabdominal fistula. If the injury is not severe, circulation may be restored and healing take place without fistulas forming. Furniss reports two cases in which clamps were on the ureters from seven to eight minutes and in both instances fistulas developed, one in eight days, the other after twenty days. Crossen in a personal communication informed me he had placed a clamp on a ureter for several minutes and a ureteral fistula followed. Kayser mentions seven cases in which only the sheath of the ureter was injured and of these, two developed fistulas. Harrington crushed the ureter in dogs with a forcep from one to thirty minutes and noted no fistulas forming, but at the point of crushing, scar tissue formed with constriction and dilatation of the ureter thus leading to hydronephrosis and degeneration of the kidney.

*Several Days After Operation.*—If both ureters have been ligated and this is not discovered until two to four days after operation, the condition

is a serious one. The patient ordinarily has a complete anuria with uremia and something very urgent must be done. Two things are to be considered: (1) Deligation of the ligated ureters. (2) Nephrostomy. Not enough cases have been handled by either method for one to draw any definite conclusion. Of course, deligation is the operation of choice, if the patient's condition is such she can endure a serious operation. It must be remembered that uremia is present and ordinarily the patient is a poor operative risk, and searching for the ligated ureters is not easy, also after locating them, can the patient stand a ureteroureteral anastomosis or whatever sort of operation one deems fit and proper? On the other hand, is nephrostomy the choice? Certainly, it seems to be the best operation when the patient's condition is grave, as it can be quickly carried out, and when the patient's general condition improves, if necessary, then deligation may be attempted. As regards double nephrostomy, Caulk has made the following statement: "In double ligation, your only chance is to do a double nephrostomy as quickly as you can. The ideal method would be immediate deligation, but this is attended with considerable difficulty, as searching for a tie on a ureter deep in the pelvic cavity several days after an extensive resection is difficult. Even in animals it is difficult to untie without cutting the ureter. In several instances in which I have known of its being done clinically, the ureter had been incised with a resulting fistula or a ureterovesical anastomosis performed at the time." Caulk and Fischer's experimental work on ureteral ligation on the dog is very interesting and deserves considerable thought. They have shown that No. 2, plain catgut when tied around the ureter was never absorbed before the end of three weeks, and that twenty-day and forty-day chromic catgut, which is the most commonly used in pelvic work is not absorbed for a much longer time, so it is useless to wait for the absorption of the catgut.

I cannot fully agree with Caulk and Fischer as to the length of time catgut lasts in the human pelvis. In the dog the absorption of catgut may be very slow and extend over a period of many days, but in the human being I am quite sure catgut is more readily absorbed, and the time of absorption is in proportion to the kind of catgut used. My opinion is based on the fact I have had occasion to open a few abdomens seven to twelve days following pelvic operations and have in some instances found the No. 2, twenty-day chromic catgut practically absorbed.

Caulk's conclusions were no doubt drawn from this piece of experimental work on the dogs and the successful management of a case of double ureteral ligation in a patient who came under his care. The patient on whom both ureters had been ligated during the course of a complete abdominal hysterectomy for fibroids, had not passed urine for eight days. It was recognized early that both ureters had been tied but the surgeon awaited developments, thinking that possibly the catgut would

loosen and the ureters would open spontaneously. At the end of the eighth day the patient became uremie. He performed a double nephrostomy upon her and during the next twelve hours 3000 c.c. of urine were secreted. Drainage through the nephrostomy tubes was free until the fifty-eighth day when the patient voided. Ten days later the urine was passed entirely by the bladder and the wound had healed. In a personal communication, Dr. Caulk informed me the patient is now living and enjoying good health.

This brings up the question of how long can a patient live with complete anuria. Caulk's patient had anuria for eight days. Myers reports 19 cases of complete anuria lasting from twenty to twenty-nine days. Farlow reports a case lasting thirty-five days, Parr forty-two days and Baily fifty days. However, these cases did not follow double ureteral ligation.

The arguments for bilateral nephrostomy as advocated by Caulk are most convincing, but when one searches the literature carefully he finds that Caulk's cases of double nephrostomy are the only successful cases reported. E. S. Judd reports a case of double nephrostomy who had an anuria for three days and seven days after the operation passed urine from the bladder. This case does not seem to be one of double ureteral ligation but rather one of urinary suppression.

Herman cites 24 cases of bilateral occlusion, 15 of which were due to encircling ligatures. The other 9 were from various causes. Of these 24 patients, 1 died without operation and the remaining 23 were operated upon. Seven died immediately following operation, a primary mortality of 30.4 per cent. The primary mortality among the 10 nephrostomy cases was 50 per cent. Among the 8 cases of deligation it was 25 per cent. All of the patients, 6 in number, who recovered from the operation of deligation were cured permanently.

In dealing with bilateral ureteral ligations the following conclusions are drawn:

1. The method of treatment, selected for the relief of bilateral ureteral obstruction will depend upon the cause of the obstruction, upon the individual choice of the operator, and upon the time that has elapsed since the receipt of the injury. Also, upon certain factors that were present at the time of the primary pelvic operation.
2. Delay in operative treatment is dangerous and will eventually result in death.
3. That deligation is the treatment of choice provided the patient's general condition can stand the strain of serious operation, and if not nephrostomy with drainage.

*Ureteral Fistulas.*—Ureteral fistulas which are the most common sequelae of ureteral injury, usually occur from three to twelve days after operation and may be either vaginal or abdominal, the former more common than the latter. Ureteral fistulas occur (a) when the ureter is severed, either partially or completely, or (b) the blood supply so injured by clamping, etc., that necrosis occurs, or (c) as a result of stripping the ureter of the blood supply, necrosis follows. A cystoscopic examination with ureteral catheterization should be performed in order to locate which ureter is not functioning into the bladder, and also to determine the



condition of the other kidney. It is probably best to wait from one to six months after the primary operation before attempting operation from the cure of the ureteral fistula as sometimes from the scar tissue contraction, the fistula is cured spontaneously. Usually in such cases a hydro-nephrosis develops with infection and death of the kidney, but if operation is attempted too early after the formation of the fistula, the patient is not in a suitable condition to stand the operation, whereas, after one to six months much better results would be obtained.

In selecting the type of operation for the cure of this condition, one must consider ureteroureteral anastomosis, ureteral vesical anastomosis and ureteral transplant into skin, bowels, etc., also ligation of ureter and nephrectomy. The aim of any operation should be to preserve the kidney and not destroy it unless nothing else can be done. Several vaginal operations have been recommended for ureterovaginal fistula correction, col-poeleisis, ureterovesical anastomosis, etc., but none of them seem to be satisfactory. It seems to me that the best plan to follow in dealing with ureterovaginal and ureteroabdominal fistulas is to put the plain facts of the condition to the patient, state the chances of a failure if anastomosis is attempted and that it might be necessary to undergo a second operation for removal of kidney. Also, discuss the removal of the kidney on the affected side, after the other kidney has been pronounced normal, and if she desires, a nephrectomy may be performed outright and thus avoid the possibility of two serious operations.

#### CONCLUSIONS

1. From the large number of cases of ureteral injury reported, it is evident that the accident is a surgical complication far more common than one would suspect.

2. No doubt some unilateral ligations occur during the course of pelvic operation and are unrecognized, the ultimate result being death of the kidney on the corresponding side.

3. The accident is liable to follow almost any pelvic operation, but usually after radical abdominal and vaginal hysterectomies.

4. In most cases the injury is unilateral. In a certain number of cases both ureters are involved.

5. The most common sequelae of ureteral injury are vaginal and abdominal fistulas.

6. As a surgical complication, ureteral injury is responsible for a certain number of deaths.

7. Prophylaxis is most important.

8. Should a ligature or clamp be placed on a ureter and serious damage inflicted, immediate repair should be done in the form of ureteroureteral or ureterovesical anastomosis.

9. In case of bilateral occlusion discovered a few days after operation,

removal of the ligatures indicated if patient's condition can stand the strain of a serious operation; if not nephrostomy with drainage.

10. Nephrostomy is a life-saving operation and should be done in all cases of double ureteral obstruction when the patient's condition is grave.

11. Vaginal correction of ureterovaginal fistula is unsatisfactory. Abdominal operation is the choice either in the form of ureteral anastomosis or nephrectomy.

12. An operation designed to correct a damaged ureter should aim to preserve the normal ureteral and kidney function.

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411 WALL BUILDING.

#### ABSTRACT OF DISCUSSION

DR. B. Z. CASHMAN, PITTSBURGH, PA.—In extensive pelvic dissections, and particularly in bilateral intraligamentous tumors, if there is doubt as to the location of the ureters, they should be exposed and kept in the field of vision at all times. The use of radium in the treatment of carcinoma of the cervix, instead of the Wertheim operation, should undoubtedly decrease the incidence of ureteral injury, but I am afraid that this will be counterbalanced by the present tendency to do total hysterectomy for benign conditions of the uterus. I looked up our cases in the Magee and St. Francis Hospitals in Pittsburgh and will give the figures for comparison. Dr. Newell reports 1202 supravaginal hysterectomies with 2 ureteral injuries. We had 1419 supravaginal hysterectomies with 2 ureteral injuries, practically the same. He reports 63 vaginal hysterectomies with 1 ureteral injury, while we had 110 vaginal hysterectomies with no ureteral injury. But in total hysterectomy he reports 5 ureteral to our 1. However, on examining the figures, I find that total hysterectomy was done 4 times as often in his series as in ours, and therein lies the story.

The principle of total hysterectomy is correct in that it removes a diseased cervix, but this can be accomplished in a much more simple manner, by thoroughly cauterizing the cervix and doing supravaginal hysterectomy. It has been stated that as most of the carcinomas of the cervix are of the squamous cell type, carcinoma develops from the squamous epithelium and therefore it is necessary to remove the entire cervix. We maintain that carcinoma develops from the squamous epithelium only, because of the adjacent chronic infection, inflammation and irritation, and that if this is thoroughly destroyed with the cautery, it heals over with squamous epithelium and there is no more danger of carcinoma arising in that cervical stump than in the

squamous epithelium of the vagina. There has been no development of carcinoma in the cervixes of our 1419 supravaginal hysterectomies, all of which were treated in this manner. On the other hand, in a series of 150 cases of carcinoma of the cervix analyzed a few years ago, we found that four had developed in the cervix after supravaginal hysterectomy, in which the cervix had not been cauterized nor was any method used for eradicating the infection in the cervix.

In the very obese patient, in the deep narrow pelvis, or when the cervix is fixed by deep tears or by contraction of parametrial tissue from long standing inflammation, total hysterectomy is a much more difficult procedure, exposure is difficult and it is in this type of patient that the ureter may be damaged. If one then decides to do supravaginal hysterectomy, a diseased cervix is left behind, thus defeating the very purpose of this operation.

In bilateral ureteral injury, while deligation would seem to be the ideal treatment in that it permanently corrects the trouble, it is much less certain and therefore is not always the practical operation. The condition of the patient and the nature of the original operation will help one to decide. If it is felt that the ureters were severed, nephrostomy is the procedure of choice. Bilateral nephrostomy is a certain method of relieving the back pressure on the kidney, the emergency which confronts the patient. The mortality of 50 per cent for nephrostomy as given by Dr. Newell is too high, I believe, and is due to delay in operating. In a patient who has anuria the next day after pelvic operation, the passage of ureteral catheters will quickly determine whether it is suppression of urine from malfunction of the kidneys, or anuria due to ureteral obstruction. If it is the latter, operation should be done at once and not after three, four, five, or six days.

DR. JAMES R. MILLER, HARTFORD, CONN.—I wish to report a case which is unusual in some respects. The patient came to me in May, 1926, with a small fibroid uterus and a large cystadenocarcinoma of the ovary the size of a 32 weeks' pregnancy. At operation about two inches of the right ureter were removed accidentally. The bladder end of the ureter had been ligated at the time of hysterectomy. The sigmoid was fortunately movable and was sutured to the right brim of the pelvis and, not knowing at that time what the Coffey method was, I implanted the ureter into the right sigmoid practically with the same technic. This patient has survived six and a quarter years, and aside from a single attack of pyelitis on the fourth day, has been entirely free from symptoms. Her bowels move three or four times in the morning without discomfort and she never has to resort to a cathartic. This spring I had her come into the hospital and was able to visualize both kidneys.

DR. NEWELL (closing).—I think Dr. Cashman is perfectly right about the proportion of total hysterectomies in relation to the supravaginal operations. Of course, this is a topic that is discussed quite often. I am more and more frequently doing the supravaginal, cauterizing the cervix, but I cannot feel that it is good judgment to leave the cervix unless it is in good condition. Our teaching is to leave the cervix if possible but to remove it if the conditions warrant at the time of operation.

There have been eight ureteral injuries by six different gynecologists, rather a small percentage.

There is much discussion regarding the choice of deligation or nephrostomy. I have felt that nephrostomy is the better operation, having seen only one case where deligation was tried. It is a most difficult thing to deligate a ureter even if it is as large as your finger and I do not think it is wise to do so if nephrostomy will be beneficial.

I have quoted a good deal from the work of Caulk and Fischer. I have disagreed with them in some respects because I have seen at autopsy that the ligatures are absorbed more rapidly than experiments would indicate. I am quite sure that in fifteen or twenty days the ligatures are absorbed.

## FOREIGN BODIES LEFT IN THE ABDOMEN AFTER OPERATION\*

J. P. GREENHILL, M.D., CHICAGO, ILL.

DURING the last three decades, there has been a remarkable improvement in the technic associated with abdominal operations. This applies not only to the increase in skill and dexterity of surgeons but also to the advancement made in the problems of operating room facilities, lighting equipment, instruments, anesthesia, and other factors. Because of the dangers to the patient of leaving foreign bodies within the abdomen and also because of the direful consequences to the surgeon of a lawsuit as a result of this, efforts have always been made to prevent such occurrences. During the last twenty-five years many recommendations have been made on how to check up the loose armamentarium used during an operation. At present most hospitals have rather elaborate systems for this purpose and the common belief is that it is an extremely rare occurrence for an instrument or a sponge to be left in the abdominal cavity after an operation. Yet a high official in a large insurance company which protects physicians and dentists against malpractice suits informed me that his company takes care of approximately one hundred suits dealing with foreign bodies each year. Also that about one in every fifteen suits for malpractice against physicians and surgeons is for a foreign body. Since there are many insurance companies which insure physicians against malpractice suits, we can only conjecture the appalling number of foreign bodies left in patients after operations.

As far as I know only three of all these hundreds of malpractice suits have been reported in medical literature, although more of them may have been recorded in the medicolegal section of the *Journal of the American Medical Association*.

The large majority of malpractice suits for foreign bodies never reach the courts because for obvious reasons they are settled out of court. In spite of this however, I found records of 68 cases of foreign bodies carried to the courts of the various states in this country from 1897, when the first case was apparently recorded, to 1925. These 68 cases represent only those cases which were taken to court and on which a verdict was rendered. Where a case was not taken to court and even where it was taken to court but no verdict was rendered, either because the suit was dropped or for some other reasons, it was not included in these 68 cases. In many of the cases where verdicts were rendered, they were in favor of the patient. Even in the cases where the surgeons were absolved from responsibility,

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most of them suffered incalculable harm as a result of the odious notoriety usually associated with such lawsuits.

The question of guilt has not been answered by all courts in the same way. In answer to a query in the *Journal of the American Medical Association* the following information was given:

“Responsibility for allowing a surgical instrument or other foreign body to remain in the abdomen after an abdominal operation rests on the party through whose default, or through the default of whose agents, it was allowed so to remain. To locate that default on the proper party, it is necessary first, to ascertain the respective duties assumed by each of the several participants in the operation, personally and through his agent. Then it must be ascertained which of such participants defaulted in the discharge of the obligations that they had assumed with respect to the patient, and by whose default the patient was as a proximate result injured. The duties assumed by each of the several participants in the operation must be determined according to their respective relations to the patient, arising out of contracts, expressed or implied, or out of the relations between the parties independent of contracts. Such relations, so far as they are not fixed by contracts, are determinable from a study of the general customs relating to such operations, and of local and special customs a knowledge of which, prior to the operation, is brought home to the patient. No hard and fast rule can be laid down for determining the division of responsibility between the operating surgeon and the hospital. Charitable hospitals, however, are in many jurisdictions held to be free from liability to their patients, except for such injuries as may result from a failure on the part of the hospital to exercise due care and skill in selection of its agents and employees.”

In certain states including Illinois, Indiana, New York, Massachusetts and others, the courts hold the following point of view. Every modern hospital has nurses who count sponges and instruments before and after operations. At the request of the surgeon they report that all the sponges and instruments are accounted for at the end of an operation. If there is a mistake in counting, it is due to negligence of the nurse who is in the employ of the hospital. The surgeon is not responsible in such a case. Unlike charitable hospitals private hospitals are not immune in any state.

The above discussion deals with foreign bodies, the presence of which sooner or later becomes known to the patient or to the patient's relatives. In addition to these cases there is a very large number in which foreign bodies are accidentally found by surgeons who usually make no mention of their discovery to the patient or to his or her relatives. In fact very few of these cases are made known to anyone except those in the operating room, because of the desire to protect the surgeon who performed the first operation. Many surgeons in conversation will reveal having removed one or more foreign bodies which they or others have left behind, but they seldom report these facts in medical literature. In support of this contention I should like to cite the report of White. This author sent inquiries to surgeons in all parts of Great Britain asking for *unpublished* cases of instruments left in the peritoneal cavity after operation. He specifically requested that forgotten laparotomy pads and gauze sponges be omitted and in spite of this he received details of 39 instrument cases. White him-

self had two cases and there were three additional specimens in the Museum of the British College of Surgeons. In this series of 44 cases, eleven patients died (25 per cent). Likewise Schachner sent letters to many surgeons in the United States and all but four reported that they themselves had left one or more foreign bodies in the abdomen.

There is still a third group of forgotten foreign bodies, namely, those in which the mishap remains unrecognized. Undoubtedly there are patients in whom foreign bodies have been left and who die of peritonitis or other causes. There is no suspicion of the true cause of the peritonitis because an autopsy is not performed. That such cases are not infrequent is proved by the relatively large number of foreign bodies which were discovered accidentally at postmortem examinations.

In the literature a relatively large number of articles devoted to this subject have appeared, especially in the first decade of the present century. The most extensive papers with a compilation of cases are those by Neugebauer (1900), Schachner (1901), Goerlich (1908), Crossen (1909), and Albitzky (1917). In reviewing the literature from 1859 to 1908 Crossen found reports of 172 sponges and 51 forceps and other articles left as foreign bodies after abdominal operations. In addition he found 18 cases of foreign body left after vaginal operations. Among the 172 sponge cases, the end-results were as follows: 83 patients (48.3 per cent) recovered, 53 patients (30.8 per cent) died, and in 36 cases (20.9 per cent), the outcome was not mentioned. Among the 50 patients with forceps or other instruments (in one patient two forceps had been left, hence the 51 instruments in 50 patients) the results were as follows: 17 patients (34 per cent) recovered, 14 patients (28 per cent) died, and in 19 cases (38 per cent), the results were not stated. Hence among the entire 222 patients with foreign bodies, 100 patients (45 per cent) recovered, 67 patients (30.2 per cent) died, and in 55 cases (24.8 per cent), the end-result was not stated. In this series of 222 cases, the original operation during which the foreign body was accidentally left, was an abdominal one in 30 cases (13.5 per cent); a pelvic one in 86 cases (38.7 per cent), and in 106 (48.7 per cent) cases, the type of operation was not listed. In 52 of the 222 cases (23.4 per cent), the foreign body was discovered at autopsy.

In Albitzky's series 56.8 per cent of the patients were females, 3.2 per cent were males, and in 40 per cent, the sex was not stated. In 80.4 per cent the foreign bodies were left during gynecologic operations, and in 19.6 per cent during other types of surgical operations. In this series 48.5 per cent recovered, 23.5 per cent died, and in 28 per cent, the outcome was unknown. In 38 per cent the foreign body was removed during a second operation, in 20 per cent it was expelled spontaneously, in 2.1 per cent it was found at autopsy and in the remaining 21 per cent there was no report as to how the foreign body was discovered.

I had the unusual experience of finding three foreign bodies within eleven months. Brief abstracts of these cases are as follows:

#### CASE REPORTS

CASE 1.—Mrs. I. B. (No. 1,043,841), aged thirty was admitted to the Cook County Hospital on January 4, 1928 because she had a persistent, purulent discharge from an abdominal wound, chills, fever, nausea and vomiting and had lost 25 pounds in the last five weeks. The family history was negative. The past history was unimportant except for two operations performed at another local hospital ten weeks and five weeks respectively before admission to the Cook County Hospital. A posterior colpotomy had

been done the first time. Five weeks later a laparotomy was performed and both tubes and ovaries were removed. (Inquiry at the hospital where the operations were performed elicited the information that both tubes and ovaries had been removed but not the uterus.) Immediately following the laparotomy, a purulent discharge escaped both from the abdominal incision and from colpotomy wound. Then the patient had chills, fever, and anorexia, and she vomited most of her food. She left the hospital in this condition. The general physical examination on admission to the Cook County Hospital revealed no abnormalities other than extensive emaciation, marked pallor, and a foul odor. The temperature was 102.6° F., the pulse was 108 per minute and respirations were 26 to the minute. The blood pressure was 110/70. The red blood cell count was 1,180,000, the hemoglobin was 30 per cent, the white blood cell count was 4,400 of which 62 per cent were polymorphonuclear leucocytes, 24 per cent were large lymphocytes, 10 per cent were small lymphocytes, and 4 per cent were myelocytes.

Abdominal examination revealed a low midline scar, well-healed, except at the lower end where there was a sinus. From this sinus foul-smelling pus escaped. Vaginal examination was made with difficulty because the introitus and the vagina were very tight. The cervix was small and hard. Behind the cervix, the colpotomy opening could be felt and through it, the same type of pus escaped as came out of the abdominal sinus. The body of the uterus could not be outlined but the entire pelvis was found to be indurated. The diagnosis made was pelvic abscess due to a foreign body or tuberculosis with secondary infection. The Wassermann reaction was negative. An x-ray picture was taken and a shadow of a straight pin was found anterior to the right half of the sacrum. Roentgen ray pictures were repeated twice on different days and the straight pin was found in the same position each time. A lateral projection picture showed the pin to be at the level of the sacral promontory.

The patient refused to be operated upon and left the hospital. We could not trace her.

The straight pin had probably been accidentally enclosed in a package of gauze pads or sponges when these were wrapped or the pin was dropped when a package of gauze pads was opened during the operation.

CASE 2.—Mrs. L. H., aged thirty, was admitted to the Cook County Hospital on May 24, 1928 because of pain in the lower abdomen. She had been married ten years but had never been pregnant. The family and past histories were unessential except for an appendectomy performed in Ohio three years before admission. The patient felt entirely well until six weeks before the present admission to the hospital. From that time on she experienced a constant, dull pain in the lower abdomen. This became progressively more severe. The pain was frequently associated with nausea but vomiting never occurred. During all this time there was a profuse foul vaginal discharge and constipation.

The general physical examination was entirely negative, except for a temperature of 99.8° F. The red blood cell count was 3,950,000, the hemoglobin 80 per cent and the white blood cell count was 8,900. On abdominal examination tenderness was elicited suprapubically and in the left iliac fossa. No masses were palpable. Vaginal examination revealed hypertrophied labia minora. There was no cystocele or rectocele. The anterior lip of the cervix was hypertrophied, smooth and not lacerated. The fundus of the uterus was enlarged, very hard, anteflexed and moderately movable. When the uterus was pushed backward the patient complained of great pain. The right tube was enlarged and tender. The left adnexa were converted into a very tender cystic, adherent mass. In addition to these masses there was a round, exquisitely tender, slightly irregular mass in the culdesac. The diagnosis made was fibrosis uteri; left tuboovarian abscess, right salpingitis and prolapse of the cystic right ovary. After the patient's temperature dropped to normal and remained so for a few days a laparotomy was per-

formed. Both tubes were enlarged and inflamed. A defundation of the uterus was performed and both tubes and the left ovary were removed. The right ovary was found to be in its normal position and in good condition. The very tender cystic mass which had been felt in the culdesae was easily shelled out and when opened proved to be a gauze sponge surrounded by a thick capsule of fibrous tissue. Convalescence was uneventful and the patient left the hospital on the eleventh postoperative day. The sponge had been left in the abdomen three years previously and had not given rise to any symptoms until perhaps six weeks before I saw her. Even these symptoms were most likely due to the salpingitis rather than to the gauze sponge which was well encapsulated and fairly clean.

CASE 3.—Mrs. A. K. (No. 68137), aged thirty-seven was admitted to the Chicago Lying-in Hospital on December 9, 1928. She had had two cesarean sections performed by two different obstetricians, one thirteen years and the other ten years before admission. She was sterilized at the time of the second operation. The menstrual history was negative and her last menses had begun November 27. Her complaint was pain in the abdomen. The general examination was negative. There were two incisions in the lower half of the abdomen which was distended by a hard, somewhat tender mass. The latter apparently rose out of the pelvis and was adherent to the abdominal scars. Vaginal examination revealed a nulliparous outlet. The cervix was long, hard, smooth and lay up high behind the symphysis and on the left side of the vagina. The fundus of the uterus was enlarged to the size of a five months' pregnancy, hard, and adherent to the abdominal wall. To the left of the uterus was a soft, slightly irregular cystic mass approximately 8 by 10 cm. in diameter. This mass was very tender. The diagnosis made was fibroid uterus and left ovarian cyst. However, because the patient had not menstruated from March to November, I wished to rule out a pregnancy such as a missed abortion. A roentgen ray picture was taken and much to my amazement a shadow of a large curved needle was seen on the right side. There were no fetal structures to be seen. An operation was performed on December 14, 1928 and great difficulty was encountered because the large fibroid uterus was firmly attached to the abdominal wall, and there were very dense adhesions between the uterus and the adnexa. The fibroid uterus and the adnexa including the ovarian cyst on the left side were removed. A search was then made for the needle, and this was found entirely buried between the folds of the mesoappendix. The needle was removed and then the appendix was amputated. There appeared to be almost no reaction around the needle for it was perfectly clean. Convalescence was disturbed by a wound infection. The patient left the hospital on the seventeenth day following operation. The needle had almost certainly been left in the abdomen at the time of the first operation because the second operator informed me that he had never used such large curved needles at any time in his career.

#### REVIEW OF THE LITERATURE

I have reviewed the literature from 1908 (Crossen's comprehensive report) to January, 1932, and found that 109 cases of foreign bodies in the abdomen have been reported in American, British, German, French, Italian, Spanish, and Russian journals. There were a few cases however, which had to be omitted because I could not secure the original journals.

Only those foreign bodies are listed which were left in or gained access to the peritoneal cavity. With the exception of six cases all the original operations were laparotomies. The exceptions were two herniotomies, a colpotomy, a sacral operation, a vaginal pack for abortion and a plastic operation for fat in the abdominal wall.



An analysis of the tabulated cases reveals the following types of foreign bodies:

Gauze	58 (52.2 per cent)
Artery forceps	38 (34.9 per cent)
Needle	4
Rubber tube	2
Retractor	2
Towel clip	1
Glass tube	1
Glass rod	1
Straight pin	1
Thick thread	1
	<hr/> 109

The foreign body was recovered at a subsequent operation in 87 cases (80 per cent), it was expelled spontaneously fifteen times (13.8 per cent), it was discovered at autopsy in 5 cases (4.6 per cent), and two patients are still carrying around their foreign bodies (pin and glass tube respectively).

In the 87 cases where the foreign body was removed by operative procedures, the means of access were as follows:

Laparotomy	75
The bladder	4
The vagina	3
Bier's suction pump	3
A fistula in the wound	2
	<hr/> 87

In 15 cases the foreign body was expelled spontaneously as follows:

Through the rectum	7
Through the wound	5
Through the urethra	1
Through the vagina	1
Coughed up	1
	<hr/> 15

The ultimate results in the 109 cases were as follows:

Recovered	76 (69.7 per cent)
Died	19 (17.4 per cent)
Unknown	12 (11.0 per cent)
Still in the patient	2 ( 1.9 per cent)
	<hr/> 109

Of the 75 patients who had subsequent abdominal operations for the removal of the foreign body, 14 or 18.7 per cent died. Among the entire 97 patients in whom the results are known, 19 or 19.6 per cent died as the result of the foreign body, hence these two death rates are almost identical. The length of time the foreign body remained in the abdominal cavity varied considerably. The longest interval recorded was twenty-four years. Likewise the size of the foreign body ranged within wide limits and in one case a laparotomy pad 72 cm. long had been overlooked during an operation for a twisted ovarian cyst during pregnancy.

## ETIOLOGY

One or more factors may be responsible for leaving a foreign body in the abdomen. Carelessness on the part of the operator and his assistants undoubtedly accounts for some cases. However unreliability of the nurses who are in charge of counting sponges and instruments before and after operations is the most important factor. Not infrequently the introduction of extra, uncounted sponges or instruments during an operation is the cause of this accident. In some cases the fault lies in a poorly administered anesthetic because of which there is considerable retching, expulsion of the intestines to the outside of the wound, rapid, forcible attempts to replace and hold the intestines back, undue bleeding, haste to complete the operation and other disconcerting occurrences. In a few cases the patient goes into shock and the operator hurries to close up the abdomen without proper inspection of the field of operation. Poor light and untrained assistants, poor exposure of the field of operation, the use of an unnecessarily large number of instruments especially small ones and failure to remove all excess fluids such as serum, blood, and pus are factors in some cases.

## PATHOLOGY

In nearly all cases there is some evidence of old or recent peritonitis. The foreign body is surrounded by the omentum and nearby organs which attempt to encapsulate it. Sooner or later however, in most cases, the foreign body exerts pressure and forces an opening into a hollow organ with or without associated signs and symptoms. After this in some cases there is spontaneous expulsion of the foreign body to the exterior but in most cases operative interference is required to remove the offender.

## SYMPTOMS

During the first few days after a foreign body has been left in the abdomen there are usually no symptoms by means of which attention would be drawn to this accident. Rarely a patient may describe the sensation of something moving around in the abdominal cavity. A clean smooth instrument is less likely to cause peritonitis than a gauze sponge or pad saturated with blood or pus. After a few days or weeks symptoms generally arise and they are usually the result of peritonitis. In most cases, the omentum rapidly demonstrates its protective mechanism by surrounding the foreign body and shutting it off from the organs in the peritoneal cavity. If this does not occur and sometimes also even when this does take place, serious disturbances arise such as intense pain somewhere in the abdomen, signs and symptoms of ileus, bladder disturbances, rectal tenesmus, abscess formation, the development of a tumor or a fistula, or the protrusion of part of the foreign body through the wound, the rectum or the bladder.

## DIAGNOSIS

If a patient has an unusual amount of pain or strange abdominal symptoms soon after a laparotomy, a foreign body should be thought of. Careful abdominal, vaginal (in women), and rectal examinations should be made with the patient lying in various positions and even sitting up. Roentgen ray pictures should be taken including both anteroposterior and lateral views. Instruments will always be revealed by this means but not gauze, unless it has been specially prepared for this purpose or unless it has a piece of metal attached to it. If a long time has elapsed since the operation and the patient has bladder symptoms, cystoscopy is indicated. If there are rectal symptoms, both a digital and a proctoscopic examination should be made before taking the x-ray pictures. If there is a sinus, which persists in spite of treatment, a foreign body should be considered. A large flexible probe should be inserted into the sinus in the hope of encountering an instrument, in which case, a metallic sound will be elicited. Lipiodol or other opaque substance should be injected into the sinus and roentgen-ray pictures taken. If gauze is in contact with the sinus, the opaque substance will saturate it thereby enabling one to detect the gauze in the x-ray pictures. If a protuberance is felt in an abdominal scar it is advisable to cut down to the mass to see what it is. If a mass is felt in the culdesac of a woman, a colpotomy should be performed. In cases where ileus is present a laparotomy is necessary; but even where the symptoms are not alarming it is occasionally advisable to perform an exploratory abdominal operation to seek the cause of vague signs and symptoms which follow a laparotomy.

## PROGNOSIS

If a foreign body is removed immediately after it is left in the abdomen, the outlook is excellent. Even if the foreign body is removed within a few days after it is left, the prognosis is very good. The sooner the second operation is performed after the first one, the easier the second operation and the better the results. In cases where the foreign body has been in the abdomen for many years, adhesions make the second operation a serious task. The fact that there was a death rate of 17.6 per cent among the patients who were operated upon in the series I collected for recent years, is proof of the risk to which a patient is subjected when a foreign body is left in the abdomen.

## PROPHYLAXIS

It is needless to emphasize that all the sponges, laparotomy pads, dressings, instruments, drains, tubes and other paraphernalia which are prepared for use during an operation must be most carefully checked up both before the operation is begun and before the peritoneum is closed. Another check up should be made while the skin is being sutured. If anything is reported to be missing, the operator must carefully scrutinize the

abdominal cavity while further search is being made by the nurses. During all operations there should be good light, and sufficient exposure of the field of operation. The anesthetic should be administered by a trained anesthetist or by someone under the supervision of a skilled anesthetist. For most laparotomies it is safest to have two assistants. All fluids such as serum, blood, and pus should be removed from the peritoneal cavity and the peritoneum should be left as clean as possible. Blood vessels, certainly the large ones and the moderately sized ones should be clamped or ligated before being cut across to avoid undue bleeding. Long instruments are always preferable to short ones and the fewer the instruments used the safer it is for the patient. It is much better to apply ligatures directly to large vessels and ligaments rather than clamps followed by ligatures. If clamps are used, they should be removed and replaced with ligatures as soon as possible. No gauze sponge, laparotomy pad, or rubber pad should be inserted into the abdominal cavity without having some kind of metal attached to it. Even when the gauze is specially prepared with a substance which will show itself on roentgen ray plates, it is still advisable to attach metal rings, clips or instruments to these pieces of gauze. If only one long piece of gauze is used throughout the operation, the surgeon should be certain that the distal end of it is pinned or tied to its container and the latter in turn attached to the sheet which covers the patient. No piece of gauze, rubber tissue or drain should ever be cut off without the surgeon knowing exactly what disposition is made of the unused pieces. Before the peritoneum is sutured, the surgeon should invariably himself carefully search the peritoneal cavity for foreign substances and then ask the nurses out loud whether all the sponges, laparotomy pads, instruments and other appurtenances are accounted for. He should not suture the peritoneum until he receives an affirmative answer. The personal search and question and answer may prove helpful in a lawsuit.

#### TREATMENT

If, while the patient is still in the operating room, the surgeon is informed by a nurse that she is sure something is missing, the abdomen should be opened without delay and a search made. If, during the first few days after an operation, there is good reason to believe that a foreign body has been left in the abdomen and certainly if an x-ray picture demonstrates it, a laparotomy should be done without delay unless the general condition of the patient is so poor that a second operation is contraindicated. There is no serious risk in waiting a few days to improve the patient's condition in such a case. In late cases, the treatment will depend upon the circumstances which are present. If there is a persistent sinus, lipiodol injection followed by x-ray pictures may reveal the source of the sinus. If it is a foreign body, it should be removed. If a tumor mass is found protruding through the abdominal wound, into the vagina or into

the rectum, the mass should be removed by incising these respective areas. If the foreign body is in the bladder it may sometimes be removed through the urethra, else the bladder will have to be incised. Foreign bodies discovered by roentgen ray pictures long after an operation was performed and which cannot be removed by a simple incision must be removed by a laparotomy as soon as the diagnosis is made. Even if a foreign body is accidentally discovered in a patient who has no abnormal symptoms, it should be removed because there is a great risk in leaving it in the abdomen.

### CONCLUSIONS

In spite of the relatively few case reports in the literature of foreign bodies left in the abdomen after operation, an appalling number of such cases occur each year. While in an occasional case, the condition seems to be unavoidable, in the vast majority of cases it is due to negligence of either the surgeon or more particularly a nurse. The condition is serious because in the present series of 109 cases which I collected, including three cases which came under my own observation, there was a mortality of at least 17.4 per cent. Most of the foreign bodies left in the abdomen were gauze sponges or pads (52.2 per cent) and next in frequency were artery forceps (34.9 per cent). The foreign bodies were detected during a subsequent operation in 80 per cent of the cases, they were expelled spontaneously in 13.8 per cent, and they were discovered accidentally at autopsy in 4.6 per cent. In this paper the etiology, pathology, symptomatology, prognosis, prophylaxis and treatment of foreign bodies are discussed.

185 NORTH WABASH AVENUE.

### ABSTRACT OF DISCUSSION

DR. JAMES W. KENNEDY, PHILADELPHIA, PA.—We give as a solution for the problem the simplest possible technic of which the surgeon may become the master. We work with three gauze towels and three gauze sponges and one assistant. This very small number of gauze towels and sponges is placed in two basins and it is easy for the surgeon to inspect the three gauze towels and sponges in each basin before and after the operation. No other piece of gauze is ever permitted to remain within the abdominal cavity.

## SIGMOIDOUTERINE AND VESICOUTERINE FISTULA AS A COMPLICATION OF CHILDBIRTH\*

WALTER C. G. KIRCHNER, M.D., ST. LOUIS, MO.

**A**LTHOUGH cases exhibiting uterine fistulas in association with childbirth occur very rarely, nevertheless, they deserve our earnest consideration, not only on account of the unfortunate plight in which the patient finds herself and the difficulty of treatment, but also because of the tendency of the cases at times to assume a medicolegal aspect.

Uterine fistulas have occurred as a result of accident or in the course of instrumental delivery, and also as a sequence of diseases involving the uterus, intestines, bladder or pelvic organs. However, it is with the idea of emphasizing the belief that intestinouterine and vesicouterine fistulas may occur spontaneously in the course of or as a result of a difficult labor, that I have been encouraged to present this paper. The problems as to the cause and the treatment of uterine fistulas associated with childbirth were brought home to me when cases of sigmoidouterine and vesicouterine fistulas were referred for treatment and operation, and an account of these cases may serve as a basis of argument and discussion. Brief recitals of the histories of these cases and comments on the reports of other cases are herewith reported.

### SIGMOIDOUTERINE FISTULA

**CASE 1.**—The patient, Mrs. B., age thirty-six, of average stature and weight, was usually in good health and was able to attend to her household duties. Only meager information was obtainable concerning her first pregnancy; however, it was stated that the delivery of the child was difficult, forceps were used, and that the child was dead or died soon after birth. The patient became pregnant a second time, and when in labor a physician was called who found it necessary to resort to instrumental delivery. Craniotomy was performed and the uterus was emptied of its contents. The patient recovered and there were no unusual complications following the extraction of the child.

On March 16, 1913, four years after the birth of the second child, the patient, in labor for the third time, sent for her former physician. On arriving at the patient's home he learned that but little progress had been made, that the pains were ineffectual, and that the patient had become quite exhausted. At the examination it was found that the presenting head was high in the pelvis and, presumably, the bag of waters had ruptured some time previously, so that, in effect he was confronted with a dry labor. Instruments were employed to assist in the rotation of the head, and even after repeated application of forceps, the patient being anesthetized, it was found impossible to deliver the child. A consultant was called, and, the child being dead, craniotomy was performed. It was stated that this latter procedure was carefully done and that no undue injury was done to the soft parts while this operation was in progress. The patient recovered nicely from this operation, and on the following day, March 17, her

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condition was very good. On March 18, the patient was feeling well and, without any warning, there was a sudden "explosion" and a considerable quantity of gas was passed through the vagina. Subsequently fecal matter was also passed through the vagina. On the two following days the condition remained unchanged. The patient had no great discomfort, and at no time was the temperature over 100° F.

A vaginal examination revealed that the discharge of fecal matter came from the cervix, though the location of the opening in the bowel was not discovered.

A proctologic examination was made and it was believed that the opening in the bowel was high up in the rectum. Practically all of the fecal matter was discharged through the vagina, very little if any stool passing through the anus. I saw the patient at the hospital and the following condition was found upon examination:

There was a fecal discharge from the vagina. All wounds of the vagina, such as follow delivery, were healed. Through the speculum it was noted that the external os was open, moderately lacerated, and that fecal matter came through the cervical canal. The cervix was adherent at the posterior portion. There was no pus; neither were there signs of inflammation. By digital examination the uterus was found slightly enlarged, adherent posteriorly at the cervical portion, though the fundus was slightly movable. The adnexa were free. The rectum was examined digitally and with the proctoscope, and even with the use of the sigmoidoscope I was unable to find the opening which communicated with the uterus. The character of the fecal matter indicated a fistula of the large bowel, and a tentative diagnosis of sigmoidouterine fistula was made and an operation for the cure or relief of the condition was recommended.

*Operation.*—It was decided to attack the fistula by the vaginal route, and by laparotomy if necessary. Ether anesthesia was administered. Through the posterior vaginal fold a dissection was made to expose the posterior wall of the cervix. The dissection was carried up as far as the fistulous tract which was loosened up and made as free as possible on all sides. The opening through the posterior vaginal wall also gave access to the culdesac of Douglas, and permitted digital examination of the abdominal portion of the fistula. Laparotomy was decided upon after a Fenger probe was inserted through the fistula into the intestine.

*Laparotomy.*—Left rectus incision. The uterus was somewhat enlarged and about the size of a man's fist. Tubes, ovaries and broad ligaments were normal but flaccid. The sigmoid flexure of the colon at a point a little below the middle portion was adherent to the uterus. There was no pelvic peritonitis and there were no adhesions aside from those taking part in the fistula. The condition resembled a lateral anastomosis of the sigmoid with the uterus, both loops of the bowel being free. The loop of sigmoid was dissected free from the lower portion of the uterus, and the opening in the bowel was closed with a double row of sutures. The opening in the uterus involved mostly the cervical portion, and this was closed, through the laparotomy opening, by means of deep and superficial sutures. A cigarette drain leading into the vagina was placed in the culdesac. There being no special complications, the abdominal wound was closed in layers. The patient was given the usual postoperative care.

Within one month all wounds were healed. The uterus was of nearly normal size, and movable. The cervix and external os were large and there was a slight thickening of the posterior part of the cervix where the repair had been made. Bowel movements and defecation were normal and painless. Menstruation was normal, and five years after the operation she was in good health.

A review of the literature revealed several additional cases which are briefly narrated for the sake of comparison.

Petit<sup>10</sup> had collected up to 1882, 18 cases of intestinouterine fistula which occurred as complications of pregnancy, but the manner in which these fistulas were produced was not always satisfactorily explained. Loenne<sup>11</sup> reports a case in which the woman

was in labor for nearly two days, the bag of waters rupturing at the end of the first day. When the pain grew less effective, the physician finally applied high forceps. A living child was delivered. On the third day there were signs of infection, the patient later becoming septic. There was pus in the stools. The patient died and at the autopsy two perforations were found in the cecum as well as a perforation in the posterior wall of the uterus. There were feces in the pelvis and a widespread peritonitis. He quoted Franque's case which was similar, there being likewise a perforation in the posterior wall of the uterus near the cervix.

In a case reported by Le Jemtel<sup>13</sup> a physician had been called in one and a half months after delivery when signs of infection had developed. He performed curettage and there was some improvement for a few days. The fever returned and shortly thereafter there was a discharge of feces through the cervix. The rectal opening closed spontaneously.

Graves<sup>10</sup> reported a case in which after forceps delivery there was a perforation of the fundus of the uterus and a prolapse of the small bowel into the vagina. The section of prolapsed bowel had been removed, but there was discharge of feces through the uterus and vagina. The integrity of the intestinal tract was reestablished and the patient made a satisfactory recovery.

Noecker<sup>17</sup> reported a case in which carcinoma of the cervix had been suspected and radium treatment had been instituted. Four months later the patient began to pass intestinal contents through the vagina. It was found that there was a perforation of the uterus which communicated with the lumen of the sigmoid and also with small bowel. A panhysterectomy was done.

Peraire<sup>18</sup> reports a case of intestinoutero-appendicular fistula which occurred subsequent to curettage, the latter being performed for a severe infection after a long and hard labor. Laparotomy was performed. The postoperative course was normal.

#### VESICOUTERINE FISTULA

CASE 2.—The patient, Mrs. T., first presented herself for treatment in March, 1924, at which time she complained of bleeding from the rectum. She had the usual diseases of childhood. When she was five years old she had prolapse of the rectum for which condition an operation was performed when she was 15 years old. Menstruation which began during her seventeenth year has always been normal. She married at the age of 21 and has had two children. At the last childbirth there was a perineal laceration the repair of which had been deferred. Although the patient's general health was excellent, it was found upon examination that the bleeding from the bowel was due to the presence of a large number of rectal polyps. An operation was performed by the writer for the relief of this condition, and some seventy-five polyps of various sizes were removed by means of the actual cautery. The patient remained in good health but three years later a polyp 5 cm. in length was removed from the lower portion of the sigmoid.

Ten years after the birth of her last child the patient became pregnant for the third time, and the family physician was directed to take charge of the case. The patient worried a great deal while carrying the child and toward the latter months of pregnancy developed pronounced symptoms of hyperthyroidism. The abdominal muscles were greatly relaxed, and the patient having refused to wear an abdominal support, the abdomen became pendulous and the uterus assumed a position of antifixion and sagged forward and downward. The family physician was thus confronted with serious complications at the time of delivery and the labor being tedious and difficult I was sent for in an emergency to take charge of the delivery.

Upon arrival at the patient's home I found that the patient was in a highly nervous state, the face was suffused, red and swollen, the heart action was rapid, there was a mitral murmur, the pulse rate 140 to 160 per minute, the patient was making frantic



physical efforts to bring about the expulsion of the child, the bag of waters had ruptured, the uterine contractions were active and forceful, the cervix was edematous and presented itself at the vulva and the head was firmly wedged in the pelvis.

A general anesthetic was administered and it was with great difficulty that the cervix was replaced behind the pubes to permit of proper dilatation and delivery. Low forceps were used to assist in the dislodgment and rotation of the head, and firm but careful traction was required to effect the delivery of the child. At no time did the instrument come in contact with any portion of the uterus or vagina adjacent to the bladder. An L.O.A. delivery of a large child was effected after some difficulty, however, the child was dead when born. A careful inspection of the passage was made



Fig. 1.—Pyelogram showing also loop of bougie inserted into bladder through vesicouterine fistula and emerging through vagina.

and there was no injury to the cervix or vagina which was apparent, nor laceration requiring repair.

The postpartum handling of the patient was left to the care of the attending physician and the course for the first three days was normal. On the fourth day the patient began to have difficulty in urination, and the bladder becoming distended, it was necessary to resort to catheterization. The bladder was catheterized daily and on the tenth day it became apparent that urine was coming from the vagina. By careful tests it was demonstrated that the urine was coming through the cervix. A retention catheter was placed in the bladder, and it was hoped that by keeping the bladder in a healthy condition and avoiding distention spontaneous closure of the fistula would take place. For two and a half months after delivery the patient received treatments directed to the cure of the vesicouterine fistula. Various solutions and injections were used without success and operative procedure for the cure of the fistula was advised.

The patient was referred to Dr. H. L. Custer for cystoscopic examination. About one-third the distance between the ureteral orifices, on the left and slightly below the interureteral fold, the opening of the fistula could be seen. A No. 3 F ureteral x-ray bougie was passed through the fistulous opening in the bladder, and the tip coming out through the vagina, it was ascertained that the fistula communicated with the cavity of the uterus. No. 5 F x-ray ureteral catheters were also passed into each ureter. Pyelograms and x-ray examinations showed both kidneys to be normal in size and position, and that low down in the bladder the small loop of the opaque catheter occupies the position of the vesicouterine fistula (Fig. 1).

*Operation.*—A bougie having been passed through the vesicouterine fistula as a guide, the patient was placed under general anesthesia. An ample transverse incision which included the outer layers, was made in the upper portion of the vagina and anterior to the cervix. With care and patience a wide dissection was made and the bladder was separated from the vagina and cervix as far as the fistulous tract. With the bougie in position, the fistulous tract was isolated and made free. It was necessary to incise the cervix longitudinally in order to remove the tract. The fistula entered the uterus just internal to the internal os of the cervix. Special effort was made to mobilize the bladder as extensively as advisable. The bougie having been removed, the fistula was tied off close to the bladder and removed. Fine catgut sutures were used for the mucosa in reinforcing the ligation. The layers of the bladder in the region of the fistula were deficient in parts, and extensive and tedious suturing was required in order to give proper support and protection to the bladder. Fine chromic catgut as continuous and interrupted sutures were used for this purpose, and special effort was made to avoid tension or strain on the sutures. It was only by adequate mobilization of the bladder that proper suturing could be accomplished. The uterus and cervix were repaired by suturing, bearing in mind the restoration of the cervical canal. The cervix, which had been badly lacerated by the previous childbirths, and also flaps of the vaginal wall were utilized in giving support and protection to the denuded portion of the bladder. After the operation for repair, which was tedious, painstaking and consumed much time was completed, a good-sized retention catheter was placed in the bladder and secured by means of strips of adhesive plaster. A small catheter was inserted well up into the vagina and this was also secured to the outer parts by means of adhesive plaster. Through this catheter a small amount of mercurochrome solution was instilled into the vagina. The patient, though somewhat exhausted by the duration of the operation, was returned to the bed in a satisfactory condition.

*Postoperative Course.*—For the first three days following the operation the temperature was elevated but after the fourth day the course was uneventful.

The free end of the retention catheter which was secured in the bladder was placed in a sterilized urinal or bottle and continuous catheterization being thus provided for, the bladder was kept empty and the slightest tension was thus relieved. At regular intervals small quantities of argyrol were instilled into the bladder through the retention catheter. In the same manner mercurochrome solution was instilled into the vagina through the catheter which had been secured in the vagina. No special pads or dressings were placed over the vulva. The requirements for the postoperative handling though exacting were simple and no special nursing was required. At the end of the second week a quantity of argyrol solution was allowed to remain in the bladder, and it was definitely determined that there was no leakage into the vagina. The vaginal wounds had also shown satisfactory healing. By plugging the end of the retention catheter, urine was permitted to remain in the bladder. At the beginning of this procedure the stopper was removed each hour and the interval was gradually increased to three hours and longer.

In the meantime the patient was permitted to get out of bed, the catheter still re-

maining in the bladder. The patient left the hospital at the end of the third week at which time there was no leakage and the bladder had been tested to hold more than ten ounces of urine. A satisfactory and complete cure of the vesicouterine fistula was accomplished.

While a review of the literature has shown that the occurrence of vesicouterine fistula is rare, nevertheless, it is important that this condition be borne in mind as one of the complications associated with childbirth.

Conaway<sup>22</sup> reported a case of vesicouterovaginal fistula and rectovaginal fistula which followed the delivery of a seven pound baby. Forceps were used and a slight laceration of the pelvic floor was promptly repaired. A few days later the patient noticed that she was unable to urinate and that the urine dribbled almost constantly and there was an odor of fecal matter about the vagina. Examination disclosed a vesicouterovaginal and a rectovaginal fistula. An operation was performed and a complete cure of both fistulas was established.

Luke<sup>23</sup> was able to cure a case of uterovesical fistula by "hystero-ostio-eleisis."

Rubins<sup>24</sup> reported a case of uterovesical fistula that had resulted after childbirth where there was apparently much sloughing of tissue. The woman subsequently became pregnant and the complications which resulted during the seventh month of gestation were such as to cause a septicemia from which the patient died.

A case of spontaneous healing in a vesicouterine fistula following labor was reported by Sims.<sup>25</sup> The patient had been in labor for sixty hours, the membrane had ruptured and an ampule of pituitary extract had been administered which gave rise to intense pain. Version was resorted to and an 8 pound 14 ounce baby was delivered. On the morning of the fifth day the patient complained of inability to hold the urine. On testing the bladder with a solution of methylene blue it was found that a small stream of the solution came from the cervical os. Following catheterization and irrigation of the bladder, a silver iodide preparation was instilled, and four weeks later the fistula was healed.

In a presentation of the subject of bladder fistulas Schmitz<sup>26</sup> narrates a case of vesicouterine fistula that had resulted from a violent curettage when the uterus was in a septic condition. At operation the bladder was dissected from an elongated wound in the body of the uterus. Healing without leakage took place. Hess<sup>27</sup> reported a case of unilateral fused kidney with uterovesical fistula which latter condition had developed shortly after delivery.

From a review of the literature it is evident that intestinouterine and vesicouterine fistulas may occur spontaneously and also as the result of trauma. The fistulas may be associated with (a) the nonpregnant uterus or with the uterus unassociated with active labor at term, or also (b) with the pregnant uterus at term.

In the first instance the causative factors may operate from the uterus to the intestine or bladder, or the process may originate in the intestine or bladder and proceed and involve the uterus. Trauma of the uterus such as may be caused by the curette or other instruments, diseases and inflammations of the uterus, namely cancer and tuberculosis, and also processes following in the course of x-ray treatments; inflammatory diseases of the bowel and bladder, and other diseases of the bowel and bladder such as cancer and tuberculosis, any of the conditions enumerated may be factors in the production of intestinouterine or vesicouterine fistula.

In association with pregnancy at or near term, these fistulas may be the result of perforation of the uterus due to instrumentation such as might occur with forceps delivery, craniotomy, curettage, etc., or to perforation of the uterus following a difficult spontaneous delivery. Perforation of spontaneous origin may be the result of a prolonged labor with impaction of the head of the child against the promontory of the sacrum in which instance the bowel may be interposed between the uterus and the promontory, or against the symphysis pubes with interposition of the bladder.

It may be observed that in many of the cases associated with pregnancy, the complication has occurred in multipara, that the child was large and well developed and often above average size, that usually the head presented, and that there was often some modification of the normal factors which are present and which function during the descent and rotation of the head. These factors may be influenced by such conditions as pendulous abdomen, previous cervical and perineal laceration, perineal relaxation, tumors, character and force of uterine contractions (at times unfavorably influenced by pituitary preparations) and a number of other conditions. The head when once impacted makes spontaneous delivery difficult or impossible. A case which apparently offers a favorable prognosis may unexpectedly be converted into a difficult case when the head becomes impacted.

An impacted head is apt to produce necrosis at the site of greatest impaction. It seems plausible that if the greatest force is applied to the uterus between the child's head and the promontory of the sacrum, then if the force and pressure is exerted beyond a certain point, the uterine wall becomes damaged, necrosis gradually takes place and ultimately perforation may take place. It may be possible to have such perforations take place with ultimate healing and with no untoward results. However, if perchance at the time of such impaction a loop of intestine has become interposed between the promontory of the sacrum and the uterus, it is evident that a necrosis of the wall of the bowel as well as of the uterus may take place. The intestinal trauma may be sufficient and may be prolonged enough to permit agglutination of bowel to uterus (the irritated peritoneum readily produces a plastic exudate), so that by the time when necrosis and perforation take place, the lumen of the bowel and the cavity of the uterus may be thus permanently connected even without an extensive peritoneal infection taking place. This is what had happened in one of our cases, the report of which accompanies this paper. In another instance the force of the impaction may be exerted against the ventral side of the symphysis pubis, and this is prone to happen when the uterus has descended abnormally or when the cervix is abnormally long. The condition is usually complicated by a prolapse and edema of the anterior lip of the cervix. The edema makes it difficult to replace the

cervix to its proper position in the pelvis. At the time of the descent of the head, the prolapse also causes a descent of the bladder which becomes interposed between the uterus and the symphysis. When the pressure is exerted to the extent of producing necrosis of the uterine wall, the bladder is very apt to become involved and when perforation takes place a vesicouterine fistula results. An instance of this sort is reported in our second case.

While instrumentation is frequently resorted to on account of the impaction and therefore difficult labor, the instrument may not necessarily be the cause of the trauma and fistula. It is rather the prolonged force and pressure exerted locally by the descending head against the symphysis or promontory that is the cause of these fistulas, which may occur in cases where the labor is difficult, and is occasioned by the impaction with impingement of the head at the site of the promontory of the sacrum or the symphysis pubis.

While it is plausible to expect necrosis and perforation of the uterus to occur in the difficult cases with impaction of the head of the child, nevertheless, uterine fistula associated with bladder or bowel following labor and not directly the result of instrumentation are very rare.

At the St. Louis City Hospital where there are some 1875 obstetric cases treated annually, there is no record of intestino-uterine or vesicouterine fistula having occurred. The textbooks on obstetrics do not mention these types of fistula. In a search of the literature it was found that the occurrence of these fistulas is rare and that in most of the recorded cases the fistulas are the result of disease and only very rarely has the fistula resulted in cases following labor.

Bearing in mind the factors involved in the formation of spontaneous fistulas, it is not unlikely that many so-called cases of enuresis paralytica are due to fistula formation and that spontaneous healing causes them to disappear. As the cause of these fistulas associated with labor becomes more apparent, it is likely that more cases will be reported and that better statistical information will be at hand.

In trying to prevent the complication due to these fistulas, it is important to recognize the observation that any abnormal condition associated with labor is a potential factor in producing impaction of the head as it passes through the parturient canal. Control of the case so as to prevent precipitate labor, dry labor, abnormal uterine contractions, prolonged labor, abnormal position of child, etc., will also help to prevent complications which result in fistula formation.

The necessity for the correction of lacerations following labor is apparent as a prophylactic measure. Proper care should be exercised in the administration of pituitary extract. When labor is prolonged and the head is engaged in such manner as to produce localized pressure, proper measures should be instituted to hasten the delivery.

The diagnosis of uterine fistula is usually not difficult. Careful inspection is essential. In the case of intestinal fistula, the character of the fecal discharge, the results of proctoscopic examination, information gained by the use of rectal injections and x-ray examinations are important in establishing a diagnosis. The diagnosis of a urinary fistula is aided or established by cystoscopic examination. Colored solution instilled into the bladder often helps to locate the position and nature of the fistula. When it is possible to pass a probe or bougie the diagnosis may be absolutely established. As previously mentioned, spontaneous healing of the fistula may take place. However, if the fistula has persisted for some time the tract has become organized and thus established and nothing short of operative interference will accomplish a cure.

Intestinouterine fistula is best treated by abdominal section which permits of proper inspection and affords greater room for manipulation and repair. Great skill in operating may be required to meet the conditions requiring correction. It may also be necessary to resort to the combined treatment in which operation through the vaginal route and laparotomy are required to effect a satisfactory cure. It is essential that cases of intestinouterine fistulas have proper preoperative preparation so that failure of the operation on this account may be avoided.

The preoperative care in cases of vesicouterine fistula is also very important. Certain fistulas have been healed by installation of silver preparations into the bladder or cauterization of the fistulous tract when this is possible. It is important to relieve the bladder of any tension due to the collection of urine, and the retention catheter placed in the bladder should be used. When the fistulous tract is not too large cure has been effected by means of electrocoagulation. Gottlieb<sup>25</sup> cured a case by passing an electrode through the cystoscope and into the fistulous opening as far as it would go. The tract was then coagulated in its entirety by slowly withdrawing the electrode with the current on. Fresh granulations gradually fill in the tract and a cure is established.

In those cases in which the tract is well established the decision must be made as to whether the approach should be made transperitoneally or by the vaginal route. In most instances the repair can be made from below unless the fistula is located high on the bladder wall. The operator should have complete information as to the character, size and location of the fistulous tract. Cystoscopic examination and the passage of a bougie along the tract furnishes useful information and is a great aid to the operator. Szendy and Szendy<sup>36</sup> have worked out an elaborate plan for the handling of vesicouterine and vesicovaginal fistulas. It must be evident, however, that no two cases are alike and that the outcome depends upon the resourcefulness of the operator. In order to meet with success in the cure of the fistula it is most essential that the bladder in the region of the tract be freely mobilized. In order to accomplish this, tedious and

painstaking dissection is required. The opening in the bladder is best closed by suture, interrupted, continuous or purse-string, using fine plain catgut. The opening must be reinforced by one or two rows of interrupted or continuous suture lines using catgut which is not so readily absorbed. It is very important that tension on the sutures be avoided, and if possible the suture lines should not be placed over each other. The repair of the uterus and the vagina must be accomplished according to the special indications. The writer has found installation of a nonirritating antiseptic solution into the vagina of value when doing plastic operations about the genitalia. In order to prevent the accumulation of urine in the bladder and to facilitate treatment, a retention catheter is placed through the urethra and secured. The catheter is worn until there is assurance that the fistula has been cured.

#### COMMENT

Intestinouterine and vesicouterine fistulas as complications of labor are rare and they may be spontaneous in origin.

Factors that are responsible for the production of variations from the normal mechanism of labor are prone to precipitate complications that may result in the production of uterine fistulas.

In prolonged labor if impaction of the head takes place, uterine fistulas may develop.

Spontaneous cures of vesicouterine fistulas have been reported.

Electrocoagulation in the treatment of uterine fistulas is worthy of trial.

In the surgical treatment of vesicouterine fistulas it is essential that the bladder be freely mobilized, that tension on sutures be avoided and that the bladder be kept empty by the use of retention catheter until healing of the fistula is completed.

1515 LAFAYETTE AVENUE.

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## ABSTRACT OF DISCUSSION

DR. H. M. N. WYNNE, MINNEAPOLIS, MINN.—In reviewing the literature on this subject I have been impressed with the number of deliveries by high forceps operations which have been followed by uterovesical fistulas. Fistulas developing immediately after delivery are due to tears while those developing after a period of several days are due to pressure necrosis.

In the examination of patients suffering from urinary fistulae the knee chest position is of great value.

Surgical repair by the vaginal route may be facilitated and made easier by the use of the Schuehardt incision. However, I believe that a more satisfactory closure can be made in the majority of cases by thorough mobilization of the bladder wall at the site of the fistula. The cure of fistulas by electrocoagulation is necessarily limited to small openings. The suprapubic operation is necessary in certain cases for adequate exposure and mobilization of the bladder.

We know that a considerable number of these fistulas have healed spontaneously. Unless a very large fistula is present, it would seem advisable to place a retention catheter in the bladder at once and give nature a chance.

In the preparation for operative closure of a sigmoidouterine fistula it may be advisable to divert the fecal current by colostomy as a preliminary measure. A large rubber tube passed through the anus above the site of the closed fistula in the bowel and allowed to remain for several days will be found of value in some cases.

DR. KIRCHNER (closing).—There are a number of these cases reported of fistula resulting from disease or from trauma. My object in presenting this paper in this way was to encourage surgeons to report their cases and to relieve us from the possibility of damage suits by giving this information. I do not believe that every case of fistula is necessarily the fault of the obstetrician. In these two cases reported the families of the patients were making preparation for damage suits. This paper was written more with the object of calling attention to the spontaneous cases than anything else.

In regard to the treatment, it should be borne in mind that the principle of mobilization of the bladder is very important. I have had occasion to reoperate on cases of vesicovaginal fistula and in those cases where mobilization of the bladder was properly done cures were obtained. Where the bladder was not mobilized, failures resulted.



# MULTIPLE DERMoids OF THE OVARY\*

JAMES RAGLAN MILLER, M.D., HARTFORD, CONN.

IT IS the purpose of this paper to review the experience with dermoid cysts of the ovary at the Hartford Hospital from 1916 to 1932, to emphasize the necessity of conservative surgery in view of the frequency of bilateral involvement, and to review briefly the literature.

Lebert<sup>1</sup> and Pauly<sup>1</sup> were able to collect 108 instances of bilateral dermoid cysts up to 1875. R. Loewy and P. Gueniot<sup>2</sup> collected 88 additional cases up to 1902. The latter authors gave the frequency as 20 in 117 where the second ovary was similarly involved, and they, as well as subsequent writers, reported no particular effect on menstruation or on pregnancy. They advised conservation of tissue by resection of the tumor only where possible. They thought the diagnosis of dermoid cysts was seldom made, and of bilateral dermoids almost never made before operation. They urged careful examination of the second ovary at operation.

Table I shows some of the larger series in which the frequency of bilateral dermoids is reported:

TABLE I

	DERMOIDS	BILATERAL	PER CENT
R. Loewy and P. Gueniot <sup>2</sup>	117	20	
W. Rosenstein, <sup>3</sup> from literature			10.40
G. Van S. Smith <sup>4</sup>	97	5	
S. A. Chalfont <sup>5</sup>	16	2	
J. M. Marshall <sup>6</sup>	415	63	15.4
Gardiner <sup>7</sup>	24	2	
Fleming <sup>7</sup>	20	1	
Lochrane and Keating <sup>7</sup>	22	6	
Mandelstamm <sup>8</sup>			14
Steuber and Brandess <sup>8</sup>			18.5
Kusudo Shogi <sup>8</sup>			15.9
August Mayer <sup>9</sup>			18.4
Lippert <sup>10</sup>			10.61
Glockner <sup>10</sup>			11
Ravano <sup>10</sup>			13.6
Gebhardt <sup>10</sup>			17.58
Ikeda <sup>10</sup>			25.4
Satow <sup>10</sup>			31.17
Mantel <sup>10</sup>			40
Present series	90	22	25

W. Blair Bell<sup>11</sup> says, "Few surgeons give any consideration to the surgical treatment of innocent neoplasms other than the complete removal of the organ. . . . As a rule some healthy portion of ovary can be preserved with its normal connections for nearly every neoplasm tends to grow away from the hilum, and the preservation of this, with adjacent ovarian tissue leaves well nourished and functional tissue."

Frank S. Matthews<sup>12</sup> emphasizes the wisdom of conserving ovarian tissue in the presence of pregnancy. The line of cleavage between cyst and ovarian tissue is easily followed. He reports six cases of bilateral dermoids of which four were associated with pregnancy. Enucleation of the dermoids was practiced in all but one case. Preg-

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nancy continued in two where corpora lutea were removed at the second and fifth months of gestation.

Eisenstädter<sup>13</sup> found three cancers in 13 dermoids; Lippert<sup>10</sup> believed cancers occurred in 3 per cent of dermoids; Hoehner<sup>14</sup> found three cancers in 7 dermoids; Wilms<sup>14</sup> states the belief that malignant growths are found more frequently in bilateral than in single dermoids.

Masson and Ochsenhirt<sup>15</sup> reviewed 33 cases of squamous cell cancer originating in dermoids and added 3 new cases. They put the frequency of such changes at from 0.5 to 5 per cent of all dermoids, urging careful microscopic examination of all dermoid cysts. Rohdenburg<sup>16</sup> found 6 malignancies among 61 dermoids.

Marshall,<sup>6</sup> in a brief report, presented what is perhaps the largest number of dermoid cysts ever reported from a single clinic (Mayo up to 1928). The outstanding features of this report are as follows:

There were 415 dermoid cysts representing 4 to 5 per cent of all ovarian tumors removed. There were 60 per cent between thirty and fifty years of age, the greatest age incidence being thirty-eight years. Twelve per cent had twisted pedicles, 15 per cent involved both ovaries, 4 per cent were infected, 1 per cent gangrenous, 1.9 per cent malignant. The dermoid cyst was an incidental finding in 32 per cent. There were 225 out of 285 married patients who had had one or more pregnancies. In none was a definite preoperative diagnosis made.

G. Van S. Smith<sup>4</sup> reported no malignant degeneration found in 97 dermoids. In 29 per cent the finding was incidental. He advises conservation of ovarian tissue if possible.

Von Franque<sup>11</sup> gives the incidence of dermoids as about 10 per cent of all ovarian tumors and states that they are often bilateral, cancer developing in 3 per cent of dermoids.

Joseph Novak<sup>13</sup> reported a patient who showed 10 dermoids in one ovary and 11 in the other.

August Mayer<sup>9</sup> puts carcinomatous degeneration of dermoids at 4½ per cent. He questions W. A. Freund's statement that hypoplasia of the genital apparatus is a fairly frequent accompanying sign of dermoid tumors of the ovary. Mayer was able to find this in only 4 per cent. Freund also spoke of the predilection of dermoid cysts for the anterior culdesac.

Loehrac and Keating<sup>7</sup> reported cancer in 2 out of 6 bilateral dermoids.

During the past sixteen years at the Hartford Hospital, up to August 1, 1932, we have observed 90 patients with dermoid cysts of the ovary, this number including patients of all physicians. Of these I have operated personally upon 22; this is a larger number than I should have expected as my share. When I noted therefore one of the histories in which one dermoid was removed followed by the removal of the other one year later, without a note of the condition of the remaining ovary at the first operation, I wondered if some instances were not overlooked. Of the 12 cases where dermoids complicated pregnancy, I found that 9 were my own, and that I had assisted with two others.

In a large general hospital where cross indexing of diagnoses is less perfectly done in the earlier years than in some of our teaching hospitals, it frequently happens that this diagnosis is not recorded, for it may be an incidental and unimportant fourth or fifth complication in the case. Some surgeons are satisfied with gross inspection of the tumor, thereby

saving the patient a laboratory fee, and in this regard the present series is not thoroughly checked.

In addition to consulting the hospital cross index of diagnoses, I have collected from the operating room records and from the laboratory a large number of added cases. Such an experience probably can be duplicated in most general hospitals. I believe, however, that the list is fairly complete.

Of the 90 patients having dermoid cysts, 12 were complicated by pregnancy, one bilateral dermoid died of peritonitis, following accidental injury of the small bowel; 12 had twisted pedicles; 22 involved both ovaries. In all, 6 cases had more than two dermoids, the largest number being 4 on one side and 2 on the other. Three incomplete operations were known to have been done, one of these having been referred to. The second patient was pregnant in the second month, and the dermoid in the ovary which contained the corpus luteum was not removed for fear of disturbing pregnancy. This patient however, aborted two weeks later. The third patient was my own in whom a small dermoid, 2 cm. in diameter, was found incidental to a complete removal of the pelvic organs. I had operated on this patient eight years previously, and a detailed note described the other ovary as entirely normal in appearance.

Of the 12 cases complicated by pregnancy, 6 patients were delivered at term by cesarean section, 4 because of blockage in the pelvis. In one of these I made a positive diagnosis substantiated by x-ray at the third month, and the cesarean section was done at the patient's request, she being thirty-nine years old in her first pregnancy. In one case the dermoid was adherent in the culdesae and was removed at a subsequent operation. In the other two the cesarean section was done for other reasons and the dermoid cyst was an incidental finding. In the 6 cases where pregnancy had advanced to the sixth to twelfth week, one came to the hospital infected with a criminal abortion. The broad ligament abscess which resulted was drained above Poupart's ligament, and I unfortunately punctured the dermoid cavity as well. After many weeks the adnexa on this side were resected successfully and the patient later became pregnant. In one case previously mentioned abortion occurred following operation, in another the outcome was not known, and in 3 I was able to deliver a live baby.

One of these cases is worthy of more detailed mention: A Danish woman, aged twenty, six weeks pregnant, had an acute attack of right-sided pain. Diagnosis of early pregnancy and twisted ovarian cyst was made and operation promptly performed. The right ovary was a twisted, fist-sized dermoid and had to be removed entire. The uterus was ante-flexed and six weeks pregnant, the corpus luteum in the left ovary lying between two dermoid cysts 2 by 3 by 4 cm. and 3 by 4 by 5 cm. respectively. At first glance, complete removal of the left ovary seemed necessary but

the cysts were carefully enucleated, suturing the cut edges of ovarian tissue adjacent to the corpus luteum with plain catgut on an intestinal needle. This patient went to term and has menstruated regularly for more than a year.

A twenty-year-old pupil nurse having a basal metabolism 20 to 30 below normal was operated upon because of bilateral abdominal tumors; one ovary containing four dermoids was removed entire; in the other the corpus luteum was located between two dermoid cysts which were enucleated as in the previous case. This patient has menstruated regularly for several months.

The preoperative diagnosis of dermoid cysts has been made on several occasions and of a twisted dermoid once, confirmed by operation.

In a recent case I made a preoperative diagnosis of bilateral dermoids of the ovary which proved to be correct. I was unable to resort to x-ray examination in this case, but was led to the diagnosis by the following considerations: One of the cysts lay in the anterior culdesac. This patient, aged twenty-four, had always menstruated irregularly, infrequently, and scantily, and the presence of a high-grade funnel pelvis suggested the possibility of abnormal developmental growths although there is probably scant basis for this conjecture. This patient was treated in a similar conservative way and is now menstruating regularly for the first time in her life. This case appears to refute the older teaching that dermoids have no influence on menstruation.

Of the 22 patients who had bilateral involvement, three had more than one dermoid in the other ovary, and two were complicated by pregnancy. The age distribution shows that 12 of the 22 were under thirty-one years and 17 were under forty-one years of age. This frequency of bilateral involvement during the childbearing period emphasizes the necessity for considering conservation of ovarian tissue.

In this series no case of malignancy arising in the dermoid cyst was noted. About 80 per cent of the dermoids were examined by the pathologist.

#### SUMMARY AND CONCLUSION

1. Dermoid cysts were found in both ovaries in 25 per cent of 90 cases and more than one dermoid in a single ovary were found in 7 per cent. This frequency demands careful inspection of both ovaries before deciding what to do.

2. Conservation of ovarian tissue by enucleating the dermoid cyst is an easy and valuable procedure when operating on a woman in the childbearing period; this may be carried out during pregnancy with little added risk.

3. The practice of relying on a gross examination is mentioned merely to condemn it, for malignancy arising in a dermoid occurs frequently enough to warrant careful microscopic examination in every case.

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179 ALLYN STREET.

## ABSTRACT OF DISCUSSION

DR. WILLIAM H. WEIR, CLEVELAND, OHIO.—Our material has been relatively limited. We do not seem to see dermoids very frequently. I have never encountered a dermoid showing malignancy, although in one case it was suspected, but the suspicious area proved to be well defined thyroid tissue. Generally they enlarge slowly by a gradual accumulation of the secretions from the skin in the interior of the cyst. It has been my practice, when encountering so-called polycystic ovaries, to puncture the numerous follicle cysts when the ovaries are to be conserved. On one occasion the contents of one cyst showed that it was a typical but very tiny dermoid. In another case the thick mucous fluid exuding from a cyst about 1 cm. in diameter showed that it was not a follicle and microscopic examination proved it to be a pseudomucinous adenocystoma. There is a decided tendency for dermoids to become necrotic and one must be very careful in palpating such cysts before packing off the abdomen, lest they rupture. On one occasion this happened with a huge dermoid reaching above the navel. Suddenly it ruptured wide open, flooding the whole abdomen with a mixture of hair, sweat, and sebaceous material, and I had difficulty cleaning up with gallons of fluid. The patient fortunately recovered but after a very stormy convalescence. Dermoids should be removed without preliminary tapping as the hair and sebaceous material will usually clog the cannula.

DR. JAMES E. DAVIS, ANN ARBOR, MICH.—There is a characteristic familial feature in a certain percentage of these cases. In certain cases all of the women will have dermoids.

Another point in the diagnosis of dermoids is that very often the macroscopic is better than the microscopic examination because, the tissues may show a total destruction of the epidermoid units but macroscopically the units can be easily recognized.

DR. EDWARD J. ILL, NEWARK, N. J.—The inclusion theory of Cohnheim as a cause for the existence of dermoids has never appealed to me. Many years ago I came across Regier's suggestion that the tumor he described, containing almost an entire skeleton, was of parthenogenetic origin. This appealed to me. Later Pfannenstiel, found that segmentation of the unfertilized ovum took place. Soon after that an American article appeared in which it was claimed that sixteen thousand serial sections of the ovary of the unfertilized guinea pig would show that such segmentation really takes place. It immediately occurred to me that here was an explanation of the reason for the production of dermoids of the ovary. It also would explain why we may find two or three dermoids in an ovary at the same time.

## PROLAPSE OF THE UTERUS\*

W. A. COVENTRY, M.D., AND RUSSELL J. MOE, M.D., DULUTH, MINN.

*(From the Duluth Clinic)*

**P**ROLAPSE of the uterus has always presented to the gynecologist an interesting problem because of the many factors involved in its causation and also in the methods to be pursued to correct the deformity that has taken place. In our series we have been particularly pleased because of the large percentage of cases in which we have been able to give complete relief to the patient.

In our series a larger percentage were due to the use of forceps in the hands of the average practitioner; a smaller percentage of patients with prolapse were confined in the home or had been confined by midwives, but practically all cases had had lacerations which had not been repaired. We have encountered only one case in a virgin, and in this case we attributed the prolapse entirely to atrophic conditions of the muscles of the pelvic floor. We have found too that the incidence of prolapse is much greater in that type of patient who has had to work hard in the home or on the farm, where the increased intraabdominal pressure accompanying this type of work is a factor in the causation of prolapse.

In determining the type of operation to be performed, the degree of prolapse is of considerable importance. The age of the patient is important also. Is the patient young? Is she in the childbearing age? Is she near or past the menopause? Is there a cystocele, rectocele, or both? Is the uterus small, atrophic, or is it of normal size? Is there marked prolongation of the cervix; is there ulceration of the cervix? Are there fibroids or are there adhesions binding the uterus? Is there a true hernia of the vault of the vagina? Have the muscles lost their tone?

The more experience one gains from treating cases of prolapse, the more one is impressed with the fact that the evaluation of these many factors is of extreme importance. We have seen a diagnosis of prolapse of the uterus made when it really was a true hernia of the vault of the vagina. We have seen it made when there was a large rectocele and the uterus decidedly fixed and in good position. We have seen it where there was a large cystocele bulging into the vulva. These errors, of course, are only made by those who are careless and who do not take the time to evaluate the exact picture that presents itself to the one making the diagnosis.

On the careful evaluation of these many diagnostic points depends exactly the type of operation that should be performed. In this paper, however, we shall consider only that type of case in which there is a second and third degree prolapse of the uterus with or without cystocele or rectocele.

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\*Read at the Forty-Fifth Annual Meeting of the American Association of Obstetricians, Gynecologists and Abdominal Surgeons, French Lick Springs, Ind., September 12, 13, and 14, 1932.

The literature is abundant with types of operations to be performed. In our opinion, any type of abdominal fixation of the uterus for prolapse should not be performed. In vaginal operations the morbidity and mortality are very markedly decreased over the abdominal route. We have seen many bad results from supravaginal hysterectomy, fixation of the uterus to the anterior abdominal wall, splitting the uterus and burying it in the abdominal wall, until now we are firm converts to the interposition operation as being the operation of choice for prolapse of the uterus. We are fully aware of the fact that in England the Manchester type is generally performed.

There are two types of interposition operation which we prefer: the Wertheim-Watkins and the Mayo vaginal hysterectomy modification. In the Wertheim-Watkins operation the uterus should be large enough to be interposed between the vaginal wall and the bladder so as to make a true wedge and firm fitting structure to secure the cystocele. If, however, the uterus is small and atrophic, I believe the vaginal hysterectomy performed after the method devised by the Mayos in which the broad ligaments are brought together and interposed between the anterior vaginal wall and the bladder gives the most satisfactory results. An important feature of the Wertheim-Watkins operation is the fixation of the cervix high in the vaginal vault. In the event amputation of the cervix is necessary the stump should be treated in the same manner. It seems needless to say that a perineorrhaphy is always necessary. The degree of the perineorrhaphy would depend largely upon the age of the patient, marital state, and the degree of laceration.

In the Mayo type of operation it is some times necessary to insert a purse-string suture, incorporating the uterosacral ligament.

Many cases of prolapse have an ulceration of the cervix, but in our experience we have never seen a carcinoma of the cervix in a second or third degree prolapse. It does not necessarily follow, however, that this cannot happen, but this has been our observation.

When should one do a Mayo type of operation? If the uterus is small, as it often is in senile women; if it is a bleeding uterus of fibrosis uteri; if the uterus contains multiple fibroids of not too large a size, then a Mayo type should be performed. If the uterus is of sufficient size to be interposed, the Wertheim operation should be done. We have in several cases where fibroids were small performed a myomectomy and then interposed the remaining uterus. It is our opinion that in all Wertheim-Watkins operations the patient should be sterilized without exception.

We wish to report a series of 110 cases, ranging in age from twenty-seven to sixty-nine years. The majority were at or near the menopause, the average age being forty-nine years. We have been able to follow up either personally or by letter 100 cases, from which the following conclusions can be drawn.

Fifty-three per cent were known to have had instrumental deliveries. The number of labors varied from one to thirteen, the average being 4.8 labors. In our series of 110 cases we had one postoperative death—a patient fifty-two years of age, operated in 1921, developed a hyperthyroid crisis which was unrecognized at the time of operation. This patient died on the second day postoperatively. Two additional patients have died since operation, one from carcinoma of the stomach and in the other case the cause of death was undetermined. From information available it had no connection with the pelvic condition.

In this series of 100 cases with complete "follow-up" 70 were of the typical Wertheim-Watkins interposition operation, the remaining thirty having the Mayo type with vaginal hysterectomy. In those of the typical Wertheim-Watkins interposition type successful anatomical results were obtained in 69 of the 70 cases, one case being a failure on account of recurrence of prolapse of the fundus through the anterior wall of the vagina. Either the uterus was too small for an interposition type of opera-

TABLE I. SUMMARY

	WATKINS-WERTHEIM		MAYO		TOTAL	
		%		%		%
Number of cases	76		34		110	
Number of follow-up	70		30		100	
Successful anatomically	69	98.6	25	83.3	94	94
Failures anatomically	1	1.4	5	16.7	6	6
Successful symptomatically	66	94.3	26	86.6	92	92
Failures symptomatically	4	5.7	4	13.4	8	8

tion or the anchoring sutures gave away. This taught us that a close anchoring of the fundus of the uterus under the pubes by four absorbable sutures is very essential. The two medial sutures should be parallel to and quite close to the urethra.

Four of the 70 cases had symptomatic failures, complaining as follows:

One had some discomfort during menses.

One had urinary incontinence of a mild degree.

Two had frequency and occasional dysuria.

These are classified as symptomatically unsuccessful results because the patient was not fully satisfied. There is some doubt whether or not the complaint is a direct result of the operative procedure. All of these four cases, however, had very good anatomical results.

The Mayo type of vaginal hysterectomy with interposition of the broad ligaments was performed in 30 cases and the end-results show a successful



anatomical outcome in 25 cases. The anatomical failures in this type of operation, five in number, had prolapse of the vault of the vagina and varying degrees of discomfort.

### CONCLUSIONS

From these observations we can draw the following conclusions:

The Wertheim-Watkins operation is the operation of choice where the size of the uterus permits its interposition.

The Mayo hysterectomy, interposition type, is indicated where the uterus is small and will not permit its interposition.

Failures in the Wertheim-Watkins operation are negligible, in our series, one in seventy.

Failures in the Mayo type of operation were 5 in the 30 cases operated. All 5 cases had a prolapse of the vault of the vagina. Failure may be prevented by better closure of the space between the broad ligaments and the uterosacral ligaments.

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205 WEST SECOND STREET.

### ABSTRACT OF DISCUSSION

DR. H. W. KOSTMAYER, NEW ORLEANS, LA.—We have a different criterion for determining whether we should do an interposition operation or a vaginal hysterectomy. We do not consider the size of a uterus so much as the degree of descent. To put it another way, if the outstanding pathologic change is that of relaxation of the anterior vaginal wall with a moderate degree of prolapse of the uterus, so-called second degree, we feel that if there is no contraindication such as disease of the uterus or fibroids, that the interposition operation is the method of choice. If there is complete descent of the uterus associated with cystocele or without it, the operation of choice is removal of the uterus. We base the assumption on the fact that after all when you are operating for prolapse of the uterus or for large cystocele you are operating because in the final analysis the broad ligaments have so elongated that they permit of descent of the uterus in the one instance, or in the case of a large cystocele you are depending on the broad ligaments ultimately to support the structure that has been damaged, that is the anterior vaginal wall. So we carry this a little further and determine the amount of broad ligament that should be removed. If we do the Mayo type of operation and there is moderate elongation of the broad ligaments, we take out as little as possible in removing the uterus. If there is an exaggerated type of prolapse we go well out on the broad ligament structure, even at times removing tubes and ovaries with it. And so we base our theory of this procedure on the fact that we are going to support the structure with the broad ligaments that have elongated so that they can no longer hold the structures within the pelvic cavity.

DR. L. A. CALKINS, KANSAS CITY, MO.—In selecting the type of operation for prolapsed uterus, I think we should perhaps pay a little more attention to etiology than has been brought out so far in this discussion. It is true that almost all cases of prolapse of the uterus do give a history of a prolonged, instrumental, or otherwise difficult labor. However, it is also true that the majority of cases of prolapse of the uterus occur in individuals who are asthenic. Ample proof of that is had from the cases of prolapsus in nulliparae. We recently had a case of prolapse in a newly born baby. Occult (or frank) spina bifida is known to be definitely associated with these cases and it is undoubtedly true that faulty nerve development is a great factor in the production of prolapse.

We therefore do not depend upon the relaxed broad ligaments in any case of definite prolapse. We do depend upon and routinely repair the pelvic floor to hold the cervix up behind, and perform a suspension operation to hold the uterus up in front. If the uterus be too small to be swung across the pelvis from anteriorly, at the symphysis, to the levator ani sling, posteriorly, we do an interposition operation because the uterus is still long enough to reach from the arcuate ligament to the strong part of the pelvic floor. We do not do a vaginal hysterectomy.

DR. F. H. FALLS, CHICAGO, ILL.—I would like to add two points to the discussion. First, as to the use of local anesthesia in these cases. A good many of these prolapses occur at a mature age and we have found that local anesthesia reinforced by morphine and scopolamine lends itself very well to the performance of this operation.

Another point is to cite a case in which a prolapse occurred in a rather elderly hard working woman. I did an interposition operation under local anesthesia followed by a perineorrhaphy. Because of her asthma and the increase of abdominal pressure, and also because of her occupation, the uterus was again completely prolapsed within a year after the interposition operation. I waited until June when her asthma was at its best and opened the anterior vaginal wall, freed, and pushed the uterus back into the abdomen. I then opened the abdomen and did a ventral fixation. Following this I overlapped the fasciae of the anterior vaginal wall and did a perineorrhaphy. The woman had a rather stormy time for a few days but recovered and was able to do her hard work afterward and, in spite of asthmatic attacks, did not have a recurrence.

One other point which I think should be made is that in all of these cases of prolapse where a plastic operation is done we routinely do dilatation and curettage and also biopsy of the cervix to be sure that there is no beginning cancer before we do the plastic operation.

DR. COVENTRY (closing).—I think Dr. Kostmayer misunderstood me. We have never had a cystocele occur after these operations, but we have had a prolapse of the vault of the vagina, after a Mayo operation, which is a difficult thing to repair. If it is repaired, it means that the vagina has to be practically closed. It is this which we have tried to prevent by incorporating a stitch, which I think was described by Frank, so as to close off the vault of the vagina.

As far as the etiology is concerned, most of our cases were not of the asthenic type. There are cases of the congenital type, but we had only one in a virgin, and that was in an asthenic type of individual. In one case of prolapse operated by Wertheim method I used a linen suture to hold the fundus well up under the pubes. I afterward did this on other cases but in this locality the linen stitch is not absorbed, so we went back to the absorbable suture and placed it so as to hook the uterus more closely around the urethra. The lifting of the stump of the cervix, or the cervix itself, very high in the vaginal vault, which is the Manchester method used in the British Empire, is exceedingly important and is probably the keynote of the entire success of the Wertheim operation.

## A REPORT OF THE END-RESULTS OF 554 CONSECUTIVE HYSTERECTOMIES\*

LOUIS E. PHANEUF, M.D., F.A.C.S., AND MAURICE O. BELSON, M.D.,  
BOSTON, MASS.

*(From the Gynecological and Obstetrical Service of the Carney Hospital)*

THE interest shown in the discussion of hysterectomy at the September, 1931 meeting of this Association, held at White Sulphur Springs, has led us to survey the operations performed on the Gynecological and Obstetrical Service of the Carney Hospital from January, 1915 to August, 1931, a period of fifteen years and seven months.

The points of interest in connection with hysterectomy are three in number, namely, (1) total versus subtotal hysterectomy; (2) the technic of operation; and (3) the end-results.

On the question of total versus subtotal hysterectomy the opinions are far from uniform. We have taken a middle ground. The age and the general condition of the patient are the factors on which the selection of the type of operation has been based. It is admitted that a badly lacerated and irritated cervix should not be left behind when hysterectomy is performed. With women at the age of the menopause we have preferred removing the entire uterus. When similar lesions are present in the younger women, we have felt that the cervix should be conserved to prevent the changes occurring in the vaginal vault following total removal. In order not to leave behind a lacerated or irritated cervix, we have treated it by trachelorrhaphy, by conical amputation (Sturmdorf), by total amputation, by cauterization, and of late, by conization with the high frequency current, using the Hyams technic and the electrode he has devised. In cases where the cervix is healthy and retained, we remove the cervical mucosa by coning it from above. By leaving a healthy cervix behind, we have overcome the chief objection to supravaginal amputation of the uterus. Given a woman in poor physical condition who needs a hysterectomy because of a benign lesion we prefer the subtotal procedure in the presence of a healthy cervix. If, on the other hand, the cervix needs attention, we do the operation in two stages, first the cervix and two weeks later the abdominal part of the operation. The technic of operation is well standardized and needs no detailed elaboration at this time. There are four distinct steps involved: (1) the removal of the uterus; (2) the tying of the vessels of each side; (3) the suspension of the cervical stump or the vaginal cuff as the case may be; and (4) the covering of all raw areas by peritoneum. Drainage is seldom necessary in the incom-

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\*Read at the Forty-Fifth Annual Meeting of the American Association of Obstetricians, Gynecologists and Abdominal Surgeons, French Lick Springs, Indiana, September 12, 13, and 14, 1932.

plete or subtotal operation. When it is, it can readily be accomplished by splitting the posterior lip of the cervix and introducing the drain in the vagina. Following the complete removal of the uterus, the vagina may be closed tightly as was done in many of our cases, or free vaginal drainage may be instituted. In many important European clinics they are leaving the vagina wide open and draining the parametria freely with gauze, preferably iodoform, claiming that the mortality and morbidity of the total hysterectomy is no greater than that of the subtotal when this procedure is employed. Interested by their results we are, at the present time, doing a series of cases with this method of drainage. We are favor-

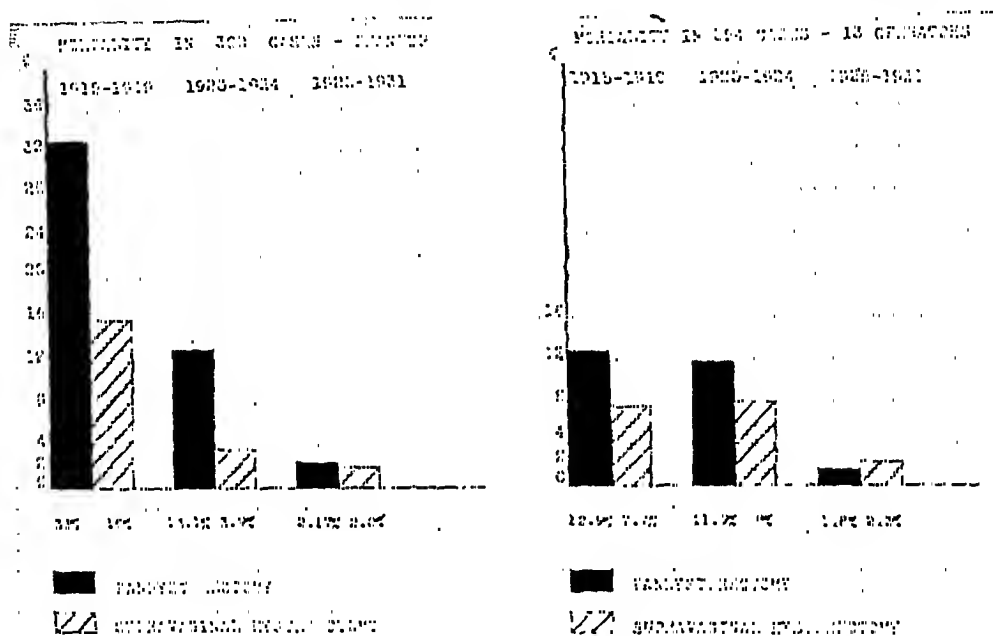


Fig. 1.—Shows the mortality of the three groups by operators. It is only fair to state that in the last two periods most of the bad risks were operated upon by one of us (Phaneuf). Taking the group of 300 cases by Phaneuf, in the panhysterectomies during the first five years, the mortality is given as 33 per cent. This group contained six cases with two deaths. One of the patients had a postoperative psychosis, jumped out of a window, and fractured her skull, whereas the other had acute cardiac failure after operation. The second five year group showed a gradual decrease in the mortality. In the last period of six years the mortality of panhysterectomy was 2.17 per cent. In the supravaginal hysterectomies the chart records a definite decrease in mortality, from 16 per cent in a small series making the first group, to 2.0 per cent in the last. Glancing at the total group by 13 operators including Phaneuf the mortality of the first two periods is but little changed, while it is markedly decreased in the last period. The chief factors in improving the mortality rate have rested in better preoperative preparation, improvements in anesthesia, shorter operating time, improved technic and better postoperative care.

ably impressed with our results although the number of patients is as yet too small to permit any conclusions.

We have analyzed the end-results of 554 consecutive hysterectomies of all types which are presented in tables and charts for the sake of convenience. Three hundred of these operations were performed by one of us (Phaneuf), and 254 by 12 other operators.

Table I shows that panhysterectomy was performed in 26 per cent of

TABLE I. DISTRIBUTION OF CASES AS REGARDS PARITY AND MENOPAUSE

	NULLIPARA	PRIMIPARA	MULTIPARA	MENOPAUSE
	Per cent	Per cent	Per cent	Per cent
Panhysterectomy	33	12	55	26
Supravaginal	43	14	43	9
Vaginal	3	11	86	54
Porro cesarean section	0	25	75	0
Hysterosalpingectomy	12.5	12.5	75	0
Wertheim	0	25	75	25

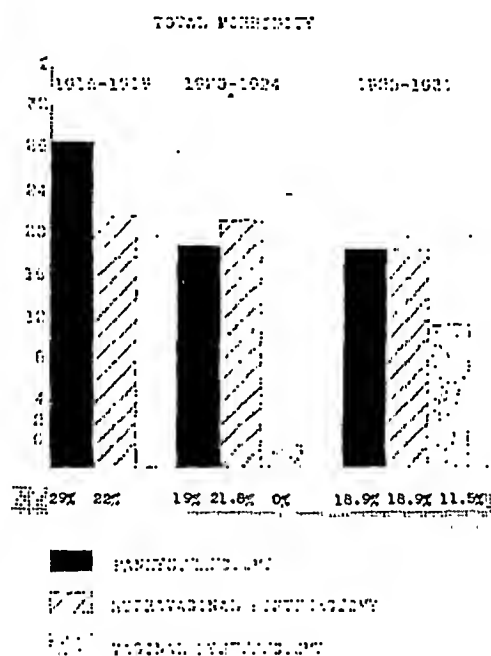


Fig. 2.—Graphically shows the morbidity in percentages. Our standard of morbidity for this purpose has been 101° F. (38.3° C.) for one day. In the first group the morbidity was greater by 7 per cent in panhysterectomy; in the second group supravaginal hysterectomy had a greater morbidity by 2.8 per cent, whereas in the last group the morbidity for both was exactly the same, 18.9 per cent. In general there is a slight decrease in morbidity. In the vaginal hysterectomies there was no morbidity in the second group. In the third group it was 11.5 per cent, which is 7.4 per cent less than it was in the abdominal hysterectomies of the same period.

the cases after the menopause as compared with 9 per cent of the supravaginal, showing that in the younger group of women an attempt was made to conserve the cervix. Hysterosalpingectomy (Beuttner operation) was performed for pelvic inflammation in young women, where the tubes showed such pathology that it was deemed unwise to conserve them, but the ovaries were healthy enough to be retained. The function of menstruation was therefore retained, although it was necessary to sacrifice the function of reproduction. It is interesting to note that 75 per cent of these patients had had more than one child, 12.5 per cent one child, and

12.5 per cent no children. The vaginal hysterectomies were performed on multiparous women in 86 per cent of the cases and 54 per cent of the patients so operated upon were beyond the menopause.

TABLE II. AGE TABLE

AGES	18-19		20-29		30-39		40-49		50-59		60-69		AVERAGE AGE
	NO.	PER CENT	NO.	PER CENT	NO.	PER CENT	NO.	PER CENT	NO.	PER CENT	NO.	PER CENT	
Panhysterectomy			8	4.4	46	25.5	88	48.8	30	16.6	8	4.4	42.56
Supravaginal	5	1.6	50	16	124	40.1	108	35.5	20	6.4	2	0.6	37.77
Vaginal			1	2.8	3	8.5	11	31.4	6	17.1	14	40	51.65
Porro cesarean section					3	75	1	25					35.5
Hysterosalpingectomy			3	37.5	5	62.5							31.0
Wertheim					5	71.4	2	28.6					37.2

Table II shows that the average age of the women who had vaginal hysterectomies was 51.65 years, indicating that this method was largely used in older women. Those who had panhysterectomies had an average age of 42.56 years, while the average age of the patients who had supravaginal hysterectomies was 37.77 years, denoting an attempt at conservation of the cervix in the younger women. The hysterosalpingectomies (Beuttner) were performed on women whose average age was thirty-one years, because we felt it was important to conserve the function of menstruation.

We have grouped in Table III the five most common symptoms complained of. By pain we mean any lower abdominal pain or discomfort. Abnormal bleeding refers to menorrhagia or metrorrhagia or both. Abdominal tumor means that the patient complained of a mass in the abdo-

TABLE III. PERCENTAGE OF THE FIVE MOST COMMON SYMPTOMS

	PAIN	ABNORMAL BLEEDING	ABDOMINAL TUMOR	VAGINAL TUMOR	LEUCORRHEA	URINARY
Panhysterectomy	56	70	9	2	30	9
Supravaginal	76	52	11	5	30	13
Vaginal	20	54	0	54	20	17
Hysterosalpingectomy	100	25	0	12	75	0
Wertheim	28	56	0	0	71	0

TABLE IV. PREVIOUS LAPAROTOMY

	Per cent
Panhysterectomy	18
Supravaginal	30
Vaginal	17
Porro cesarean section	25
Hysterosalpingectomy	25
Wertheim	0

TABLE V. ASSOCIATION OF PERINEAL OPERATIONS WITH HYSTERECTOMY

	LAPAROTOMY				LAPAROTOMY AND PERINEAL			
	SIMPLE*		COMPLICATED		SIMPLE		COMPLICATED	
	NO.	PER CENT	NO.	PER CENT	NO.	PER CENT	NO.	PER CENT
Panhysterectomy	100	56	50	28	17	9	13	7
Supravaginal	110	34	150	47	19	6	41	13
Porro cesarean section			4	100				
Hysterosalpingectomy	1	12	2	25			5	63
Wertheim			7	100				

\*Simple = Single anatomical or pathologic defect.  
Complicated = More than one.

TABLE VI. OPERATIVE COMPLICATIONS

	1915-1919		1920-1924			1925-1931		
	PAN.	SUPRA-VAGINAL	PAN.	SUPRA-VAGINAL	VAGI-NAL	PAN.	SUPRA-VAGINAL	VAGI-NAL
Bladder injured		1		1		1	1	
Bowel injured	2	1		1			1	
Uterus torn from cervix	1							
Heart	1							
Ureter constricted								1
	4 or 4.7%	2 or 1.9%	0	2 or 2.3%	0	1 or 1.8%	2 or 1.4%	1 or 3.8%

*Total Years:*

Panhysterectomy 5 or 2.7%  
Supravaginal hysterectomy 6 or 1.8%  
Vaginal hysterectomy 1 or 3.8%

men. Vaginal tumor denotes any prolapse or bulging at the vaginal introitus. Leucorrhea and urinary symptoms are self-explanatory. The percentage of bleeding was greatest in the panhysterectomies, being mentioned in 70 per cent as compared with 52 per cent in supravaginal and 54 per cent in vaginal hysterectomies. Pain was most common in the hysterosalpingectomy group, being present in 100 per cent of the cases. Vaginal tumor or bulging was found in 54 per cent of the vaginal procedures. Leucorrhea was the second symptom in prominence in the hysterosalpingectomies occurring in 75 per cent of them.

Previous laparotomies had been performed in 18 per cent of the panhysterectomies, 30 per cent of the supravaginal hysterectomies, and 25 per cent of the hysterosalpingectomies, showing that an attempt at conservation had been made without relieving the symptoms.

Table V presents the association of perineal operations with hysterectomy. Simple laparotomy refers to a single anatomical or pathologic defect, while a complicated laparotomy refers to more than one defect. In the panhysterectomies, 56 per cent were simple and 28 per

TABLE VII. POSTOPERATIVE COMPLICATIONS

	1915-1919		1920-1924			1925-1931		
	PAN.	SUPRA-VAGINAL	PAN.	SUPRA-VAGINAL	VAGINAL	PAN.	SUPRA-VAGINAL	VAGINAL
Ileus	1	2				1	1	
Peritonitis	1	1						
Pulmonary embolus		2						
Shock	4	1		2				
Incisional abscess	1							
Separation of incision				1			2	
Phlebitis	1			1			1	
Intestinal obstruction			1					
Myocarditis			2					
Pneumonia		2		1				
Incisional hernia	1							
Pelvic abscess	1							
Furunculosis	1							
Liver abscess	1							
Anuria								1
Fecal fistula							1	
Postoperative insanity		1						
	12 or 14 %	9 or 8.6 %	3 or 7.1 %	5 or 5.7 %	0	1 or 1.88 %	5 or 3.9 %	1 or 3.8 %

*Total Years:*

Panhysterectomy	16 or 8.8 %
Supravaginal hysterectomy	19 or 5.9 %
Vaginal hysterectomy	1 or 3.8 %



cent were complicated as compared with 34 per cent simple laparotomies and 47 per cent complicated in the supravaginal. It is evident from this that in the supravaginal group there were more complicated anatomical

TABLE VIII. OPERATIVE PROCEDURES

	PAN- HYSTER- ECTOMY	SUPRA- VAGI- NAL	VAGI- NAL	WER- THEIM	PORRO CESAREAN SECTION	HYSTERO- SALPIN- GECTOMY
Panhysterectomy	180					
Supravaginal hysterectomy		320				
Vaginal hysterectomy			35			
Wertheim radical hysterectomy				7		
Porro cesarean section					4	
Hysterosalpingectomy (Beutner)						8
Salpingectomy, double	154	246	7		3	
Salpingectomy, single	10	36	2			
Oophorectomy, double	151	235	7		3	
Oophorectomy, single	15	49	2			1
Appendectomy	68	137			1	5
Cystectomy, parovarian		1				
Ovarian transplant	1	8				
Bowel repair	2	3				
Bladder repair	1	3				
Cholecystectomy		1				
Drainage of pelvic abscess	1					
Obliteration of culdesac of Douglas (Moschowitz)		3				
Herniorrhaphy, ventral		3				
Herniorrhaphy, umbilical	3	1				
Herniorrhaphy, inguinal	1	2				
Herniorrhaphy, femoral		1				
Citrate transfusion	11	9		1	1	
Intestinal resection and anastomosis		1				
Cecostomy	1	1				
Gastroenterostomy undone		1				
Curettage	24	34	1			3
Cauterization of cervix		9				1
Amputation of cervix		8				2
Trachelorrhaphy		12				
Anterior colporrhaphy	2	14	4			1
Perineorrhaphy	6	23	24			2
Third degree perineorrhaphy			1			
Vaginal myomectomy		1				
Interposition of broad liga- ments			13			
Fixation of broad ligaments to vaginal cuff			1			

defects. The association of perineal operations with the laparotomy was almost equal in both groups of cases.

Dividing the cases in three periods, we find a decrease of complications in the last period. They were, as shown in Table VI, 1.8 per cent for the total hysterectomy and 1.4 per cent for the subtotal. The complications were essentially bladder and bowel injuries. In the vaginal hysterec-

tomies there were no operations in the first period, there were no complications in the second period, and one complication or 3.8 per cent in the third period, which was the constriction of an anomalous ureter.

Table VII shows that the postoperative complications in the panhysterectomies, which were greater than in the subtotal in the first two periods, became less than those of the supravaginal in the last period, the ratio being 1.88 per cent for the total against 3.9 per cent for the subtotal. In considering the whole group the vaginal hysterectomy has the least number of postoperative complications.

Table VIII shows that in 180 panhysterectomies 451 additional procedures were done. In 320 supravaginal hysterectomies 842 supplementary operations were recorded. In 35 vaginal hysterectomies we find 62 additional procedures. In 7 Wertheim radical dissections the only addition was a preoperative blood transfusion. In 4 Porro amputations there were 8 additional operations, while in 8 hysterosalpingectomies there were 15.

Table IX presents the chief operative diagnoses in the various groups and is self-explanatory. The 16 panhysterectomies for carcinoma of the cervix had had previous radium treatment.

Table X reports the additional operative diagnoses. These are apparent and need no comment.

TABLE IX. CHIEF OPERATIVE DIAGNOSES

	PAN-HYSTERECTOMY	SUPRA-VAGINAL	VAGINAL	WER-THEIM	PORRO CESAREAN	HYSTERO-SALPINGECTOMY
Chronic pelvic inflammation	18	120			1	4
Chronic salpingitis	2	3				4
Pelvic abscess		2				
Myomata uteri	87	158	2		1	
Fibrosis uteri	2	6	2			
Hypertrophic endometritis	6	2				
Hyperplastic uterus	6	7				
Essential menorrhagia and metrorrhagia	12	11	7			
Placenta accreta		1				
Inverted puerperal gangrenous uterus	1					
Infected pregnant uterus with cephalopelvic disproportion					3	
Ruptured ectopic pregnancy	2	5				
Ruptured uterus	1	2				
Endometriosis	1	7				
Carcinoma of ovary	1					
Ovarian cyst (dermoid)	2	1				
Ovarian cyst (benign)	21	51	1			
Parovarian cyst		1				
Carcinoma of fundus uteri	25					
Carcinoma of cervix uteri	16			7		
Cervical polyps	4		1			
Procidencia			26			

TABLE X. ADDITIONAL OPERATIVE DIAGNOSES

	PAN-HYSTER-ECTOMY	SUPRA-VAGI-NAL	VAGI-NAL	WER-THEIM	PORRO CESAREAN	HYSTERO-SALPIN-GECTOMY
Rectocele		21	8			
Relaxed perineum	6		1			1
Enterocele		3				
Cystocele	1	12	2			1
Lacerated cervix	19	17	8			3
Erosion of cervix	10	2	2			
Cystic glands of cervix	2					
Prolapse of uterus	2	12				
Retroversion of uterus	2	4				
Chronic appendicitis	13	28				
Cholelithiasis	5	7				
Diabetes	1	1	1			
Tabes dorsalis	1					
Ruptured corpus luteum with hemorrhage	1	2				
Hernia, ventral	1	3				
Hernia, umbilical	3	1				
Hernia, inguinal	1	2				
Hernia, femoral		1				
Uterus bicornis, bicollis		1				

## SUMMARY

1. There are 554 hysterectomies of all types reported as follows: 180 panhysterectomies, 320 supravaginal, 35 vaginal, 7 Wertheim, 4 Porro and 8 hysterosalpingectomies (Beuttner). They are grouped in three periods.

2. In our last group of cases, covering the years 1925 to 1931, the mortality of panhysterectomy has been half a per cent lower than that of supravaginal.

3. In this same period of time the morbidity for the two methods has been exactly the same.

4. Vaginal hysterectomy is an ideal method in older women where sufficient relaxation of the vagina exists to give easy access to the pelvic organs.

5. The chief symptoms for which the operation was performed were pain, hemorrhage, and tumor.

6. The average age of the patients who had vaginal hysterectomies was 51.6 years, panhysterectomies 42.5 years, supravaginal hysterectomies 37.7 years, while the hysterosalpingectomies, (Beuttner) were performed on women whose average age was thirty-one years.

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## ABSTRACT OF DISCUSSION

DR. JAMES F. BALDWIN, COLUMBUS, OHIO.—My particular interest is to emphasize the importance, in practically all cases of hysterectomy, of removing the cervix. I know of more than forty cases in which, after supracervical amputation, cancer devel-

oped in the cervix. In all of these cases the disease appeared long after the original operation.

The unremoved cervix is liable, particularly in women who have borne children, to develop cancer, is frequently the source of an annoying leucorrhœa, and sometimes of pronounced dyspareunia. In one of my cases the cervix, which had been left behind after a panhysterectomy by a Birmingham surgeon twenty-five years before, had become the starting point of a very ugly mass of fibroids, quite filling the pelvis and weighing more than four pounds. The cervix itself was scarcely larger than the last joint of the little finger, but these fibroids had sprung from the upper end.

That a nulliparous cervix is less liable to make trouble than a multiparous one, is admitted; but no remnant cervix is without ample possibilities of disease, is of no possible use, and its removal as a prophylactic measure is clearly indicated. I have been obliged in a number of instances to remove through the vagina the cervix that had thus been left; and such removal is infinitely more difficult, more time-consuming and vastly more dangerous than its removal at the original operation.

With the proper exposure of the pelvis by the Trendelenburg position, and care to see that the bladder has been previously emptied, it would seem to be practically impossible in any way to injure the bladder, ureter or bowel; and with peritonealization as advised, intestinal obstruction would apparently be entirely out of the picture. This statement is based on a personal experience of over 6000 hysterectomies. On a very few occasions it was found necessary to remove the lower end of a ureter involved in the cancerous growth, and to implant the proximal end in the bladder; these cases all did well. On one occasion the cancer had so involved the right ureter that its excision left the ureteral stump too short for implantation into the bladder. The ureter was therefore ligated tightly with silk and dropped. The patient made a fine operative recovery, but died of cancer a little more than a year later. Autopsy showed that death had occurred from metastasis to the retroperitoneal glands, but there was no involvement whatever of the pelvic tissues. The kidney, which had given no trouble whatever, was found somewhat contracted and with a slight dilatation of the ureter above the ligature.

In another case, of similar character, a large portion of the left ureter was exposed in removing the cancerous tissue. The uninjured ureter was carefully covered with peritoneum but there had been too great an interference with the blood supply and a few days later a ureterovaginal fistula developed, provision for which had been made by a little drainage wick. The patient made a good recovery, but in due time it seemed wise to remove the kidney; this was done without difficulty and with complete, though necessarily not lasting, convalescence.

A few suggestions as to technic may be in order. So far as I can learn few operators take pains, at least the pains that I always take, to sterilize the vagina before opening the abdomen. The danger of infection coming from the vagina is of such vital importance that I never trust the cleansing to an assistant. I wash out the vagina thoroughly personally with tincture of green soap and hot water, being careful to thoroughly reach every part. Then, lest infection might enter the vagina from the uterine cavity, I catch the anterior lip of the cervix with a volsellum and fill the uterine cavity with full strength tincture of iodine by means of a special pipette. Some of this iodine runs back into the vagina, but I at once flush the entire vagina with one-fourth strength tincture of iodine, so that I can look upon that entire area as well sterilized, and its sterility, I think, has been demonstrated by the fact that I have never had a peritonitis coming from that source.

Another very important feature of the operation, after attaching the ligaments to the vault of the vagina, is, as the author states, the peritonealization of all bare surfaces. This can usually be done by bringing over adjacent peritoneum, but in some cases can only be done by leaving the vagina open and passing into it the ends of three strips of iodoform gauze, each strip a yard long and 12 inches wide, with the raw edges turned in so as to avoid ravelings. The rest of the strips are then carefully placed so as

to fill the true pelvis, and over these the sigmoid is swung around and attached by a continuous suture to the brim of the pelvis. There is thus no raw surface left exposed. This gauze fluff is left undisturbed for one week, and then is easily withdrawn by catching the vaginal ends. The use of this gauze fluff obviates all fear of postoperative adhesions and postoperative ileus. (This method of utilizing the sigmoid was introduced by Dr. J. E. Summers, of Omaha, Neb., *Surgery, Gynecology and Obstetrics*, August, 1911.)

Generally only four ligatures are necessary, one on each uterine and one on each ovarian artery. Occasionally some branch will require a ligature; but, as I demonstrated by dissection a good many years ago, the round ligament arteries with the rarest possible exception never need ligation.

I see no reason for making a two-stage operation of a hysterectomy, removing the cervix at the first and a few weeks later subjecting the patient to a second operation for removal of the body of the uterus. The removal of the cervix by an experienced operator will require but an additional minute or two, and frequently will require less time than to properly implant the ligaments into the cervix and peritonealize the field of operation.

In all ordinary hysterectomies, the vault of the vagina should be closed by a purse-string or transverse continuous suture catching the submucous tissues, followed by a continuous suture bringing the peritoneum together. No provision for drainage is necessary. In women under forty it is usually desirable, if the organs are healthy, to leave the tubes and ovaries, or at least one ovary. Leaving the tubes saves a little time and gives a better blood supply to the ovaries. These appendages should be attached high up on each side of the pelvis, so as to avoid any possibility of dysparemia which is so apt to occur if they are allowed to drop, as is so frequently the case, to the bottom of the pelvis.

The death rate in ordinary hysterectomy should not exceed 1.5 per cent, but in cases of malignancy or preexisting infection the death rate will necessarily be higher.

DR. P. B. BLAND, PHILADELPHIA, PA.—While there is still some controversy with regard to supravaginal versus complete hysterectomy, I personally perform the less formidable operation whenever possible, because the operation is infinitely easier to perform and the results both immediate and remote are far better than after the major operation.

My personal records of gynecologic operations show, in 1500 consecutive operations, 202 hysterectomies, an incidence of 1.3 per cent. These included 146 supravaginal operations, 26 complete operations and 30 vaginal operations. The age of the patients varied, the youngest being 25 and the oldest 71. The average ranged from 25 to 40. There were 8 deaths, a mortality of 3.9 per cent, divided as follows: After supravaginal operation 4; after complete hysterectomy, 3; after vaginal operation, 1, or 3.10 per cent.

In one hospital I covered the clinical records of 3103 gynecologic operations and found that 298 hysterectomies were performed, an incidence of something less than 1 per cent. These included 221 supravaginal, 52 complete, and 25 vaginal operations. The age of the youngest patient was eight and the oldest seventy-one. In the 298 hysterectomies performed there were 11 deaths, a mortality of 3.7 per cent, divided as follows: after supravaginal 3; after the complete operation, 3; after the vaginal procedure 5.

DR. JAMES E. KING, BUFFALO, N. Y.—The discussion has apparently focused upon the question of whether panhysterectomy or the supravaginal method is preferable. For me that has not, in recent years, been a problem because I believe that the diseased cervix, excluding carcinoma, of course, can be taken care of satisfactorily with the cautery.

My big problem has been with the patients who have not reached the menopause. In such cases it has been my practice in doing a supravaginal operation to leave the ovaries.

My experience with some of these patients has been unfortunate as they have returned to me with ovarian cysts or other ovarian conditions which have required operation. This occurred in spite of the fact that at the first operation the ovaries were apparently perfectly normal according to the operative report.

DR. GEORGE GELLHORN, St. Louis, Mo.—Dr. Phaneuf has shown convincingly that to him who takes the trouble of perfecting his technic, *total abdominal hysterectomy* is attended with no greater danger than the *supravaginal* operation, and I am in hearty accord with that idea. I was even more pleased with the emphasis laid upon vaginal hysterectomy. The value of vaginal hysterectomy cannot be overestimated; yet, this operation has not become popular among gynecologists. This is all the more surprising as major vaginal operations really originated in this country. Robert Battey of Rome, Georgia, in 1876, was the first to approach the genital organs through the vagina. His example was followed a decade or so later in Germany where the technic of vaginal operations was extended to a high degree of perfection. In America, however, these operations have fallen into disuse, and the present generation of young gynecologists grow up without receiving instruction in this particular field. This is rather deplorable because the advantages of vaginal over abdominal operations are indisputable in a large number of cases.

DR. JAMES W. KENNEDY, PHILADELPHIA, PA.—At present I remove the uterus by the vaginal route, clamp method, in about 95 per cent of the cases. At this moment I am willing to go on record by the prophecy that in the future there will be a greater number of vaginal hysterectomies performed. I have given up the ligature method of performing the vaginal hysterectomy and have adopted the clamps in the removal of the uterus. The clamp method will increase the percentage of operability to a marked extent.

It is very much more thorough from the standpoint of tissue removed than the ligature method and therefore we have adopted it in the malignant conditions of the uterus. The slough which follows the clamp method of vaginal hysterectomy occurring on about the twelfth postoperative day is, in our opinion, a very important and eventful influence in its splendid results in the surgical treatment of the malignant uterus.

The death rate of vaginal hysterectomy, clamp method, has been in our experience in the Joseph Price Hospital a fraction of one per cent.

DR. JAMES E. DAVIS, ANN ARBOR, MICHIGAN.—The controversial points involved in hysterectomy would be cleared if the selection of cases were the same by the different operators. In the group of cases studied by me a couple of years ago and reported before this Association a number of uteri were removed where there was no indication for the removal except a slight hypertrophy or metaplasia of the myometrium. A study of these cases in a large percentage of instances would have shown the pathology was in the ovary, or in the ovary and the pituitary. The endometrium is under the control of the ovary and possibly the pituitary. These uteri could be left alone and a number of deaths obviated, especially in the hands of the inexperienced operators.

Important points have already been made in regard to the indications for the removal of the cervix. It is worthwhile to emphasize the thought that if there is no infection, if the appearance indicates that the cervix is without pathology, then perhaps it could be safely left. If the cervix is lacerated, as is the case in the vast majority of instances, there will be found also erosion and infection, then removal or destruction of the endometrium should be accomplished. By so doing one adds a great measure of prevention against malignancy.

DR. F. S. WETHERELL, SYRACUSE, N. Y.—With the increased use of spinal anesthesia, a danger which is often lost sight of is that with a relaxed rectal sphincter and with the patient in the Trendelenburg position, some fecal material might be evacuated and travel into the vagina. When spinal anesthesia is used, the vagina should invariably be packed before the abdomen is opened.

## PLACENTA ACCRETA\*

### CONSERVATIVE VERSUS RADICAL TREATMENT, WITH A REPORT OF THREE CASES

E. LEE DORSETT, M.D., ST. LOUIS, MO.

**P**LACENTA accreta is a definite pathologic entity and should not be confused with retained placenta or adherent placenta. Polak states that in his experience it has occurred once in 6000 cases, while Foster of the Montreal Maternity reports it occurring once in 8000 cases. It is not the rarity of this condition that has prompted the report of these cases, but to bring out the fact that delay in diagnosis and treatment leads to disastrous results. The three cases here presented illustrate the condition from three different angles; the too conservative treatment; the conservative treatment at first, followed by radical treatment; and lastly, the immediate radical treatment.

The anatomic histologic picture of placenta accreta shows a more or less absence of the spongy layer of the decidua basalis. The villi penetrate the uterine muscle and in some areas become a part of the musculature; a number of cases have been reported in which the penetration has been down to the peritoneal covering of the uterus.

J. N. Nathanson is of the opinion that atrophy of the endometrium is a predisposing cause and also that the improper development of the corpus luteum causes a limited development of the decidua. It seems to be the consensus of opinion among the writers that a previous curettement is a cause of this condition and this point is brought out in the history of two of the cases herein reported. Previous pregnancies and manual removal of the placenta in other pregnancies have a bearing in causing this condition. All three of these cases were multiparous women, but none gave history of adherent placenta.

Experience shows how futile it is to try to remove the placenta or a greater part of it, from its implantation on and in the uterine wall, without a most severe hemorrhage or if the tissue is not all removed, an infection follows in an already exsanguinated patient. Where we are dealing with an adherent placenta, there is a definite decidua basalis present, and the placenta has not become more or less a part of the uterine muscle, so that when the hand explores the uterine cavity in an attempt to remove the placenta a definite line of cleavage is found, and it can readily be stripped from its attachment.

A great many of us are to be criticized as to the management of the third stage of labor. We are anxious to finish our case, and by too violent mas-

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sage on the fundus, or retraction on the cord, or both, we hasten the third stage of labor. Just how long to wait before the placenta is expelled is a matter of personal opinion, but it seems to be an unwritten law that the placenta should be expressed at the end of twenty minutes. There should be no difficulty in recognizing a retained placenta but an adherent placenta and placenta accreta can only be diagnosed when the hand is introduced into the uterine cavity. A disturbance in mechanism is the underlying factor in the delay in the separation of an adherent placenta, but, as before stated, placenta accreta is entirely pathologic.

When it has been decided that a manual removal of the placenta is indicated, it should be done with the utmost care and having in mind the fact that if a definite line of cleavage cannot be determined, there is a placenta accreta present that cannot be removed. Furthermore if an attempt is made to remove it the patient will suffer from shock and hemorrhage, or the uterus may be perforated. In all of the cases reported here, an attempt was made to remove the placenta. Large pieces were removed, and in all cases this maneuver was followed by terrific hemorrhage. In the first case four attempts were made to remove the placental tissue without satisfactory results. Each time the patient had a hemorrhage, was packed, and required blood transfusion. A dull curette was used but very unsuccessfully because of the fear of perforating the uterus. This case developed sepsis and a pelvic abscess. The abscess was drained and after seven weeks the patient made a good recovery.

The second case had two attempts at removal of the placental tissue, was packed, had blood transfusions, and an unsuccessful attempt was made to ligate the uterine arteries from below. On the fourth postpartum day a total hysterectomy was performed, but the patient died of general peritonitis.

The third case was a patient thirty-six years old who had borne four children, had six abortions, four of the abortions requiring a curettement. In her last pregnancy she complained of constant uterine pain and on numerous occasions had severe uterine contractions. Her labor was precipitate at full term, a breech presentation with a prolapsed cord. A living baby was delivered, but after waiting forty-five minutes, an attempt was made to expel the placenta by the usual methods. This was unsuccessful, so a manual removal was decided upon. When the hand was introduced into the uterus the placenta was found to be firmly adherent with no line of cleavage present. Several large pieces were torn loose from the uterine wall followed by a copious hemorrhage. The uterine cavity was packed and the patient returned to bed and transfused. The patient was allowed to rest several hours and then was removed to the operating room and a supracervical hysterectomy was performed and the patient again transfused. This patient made a most remarkable recovery and left the hospital on the twelfth postoperative day.

The one successful case herein cited cannot be held up as being the cor-



rect method by which to treat this condition. The cases are so few and far between that even with all the cases collected and reported, we could not then pass judgment. From the meager reports so far found in the literature, there seems to be no doubt in the opinion of the writer that an immediate hysterectomy is indicated.

Kloppen reports 46 cases with a mortality of 87.5 per cent when they were conservatively treated, as compared to 14.3 per cent when treated radically (by hysterectomy).

#### CONCLUSIONS

1. The three cases here presented are examples of conservative, and delayed radical treatment and immediate radical treatment.
2. Where no line of cleavage is present, and it is impossible to remove the placenta, hysterectomy should be performed as soon as possible.
3. Blood transfusion where there is severe hemorrhage is of the utmost importance.

#### CASE HISTORIES

CASE 1.—A woman, twenty-two years old, had one child two years previous to this pregnancy. At this time she had eclampsia. Entered hospital with history of one convulsion and only had one more after the intravascular injection of magnesium sulphate. At the time of her first delivery she had a third degree laceration of the perineum. It failed to heal and was subsequently repaired. August 6, 1924, she again entered the hospital in labor but two months premature. She delivered spontaneously of a 1820 gm. baby (died on the eleventh postpartum day). An attempt was made to express the placenta, but the usual method failed so a manual removal was attempted. No line of cleavage was found, and wrongly an attempt was made to remove the placenta piecemeal, with the result that the patient very nearly bled to death on the delivery table. The uterine cavity was packed, the patient returned to bed, 750 c.c. of citrated blood given intravenously. On the following day another attempt was made to remove the remaining pieces of placenta with a curette, but this was not very successful, and the patient again bled very profusely, was packed, and transfused. The packing was removed in twenty-four hours, and hemorrhage followed. She was again repacked and transfused. This procedure was again attempted on the following day with the same results and treatment. The fifth day very little hemorrhage followed the removal of the packing, but the patient began showing signs of sepsis and developed a pelvic cellulitis. A pelvic abscess developed, followed by operation four weeks after delivery. After a very stormy convalescence the patient recovered and left the hospital seven weeks after labor.

CASE 2.—Patient, aged thirty-five, gravida 4. Entered hospital in labor at full term. Had one abortion previous to this pregnancy and was curetted. In labor thirteen hours and delivered spontaneously of a living child. The placenta did not separate and an attempt was made to remove it manually. About half of the placenta was removed, but further attempt was impossible due to severe bleeding. The uterus was packed and the patient transfused. The following day an attempt was made to remove the remaining remnants of placental tissue with a dull curette, but this was not successful due to hemorrhage. The uterus was again packed and patient again transfused. Later in the day an attempt was made to ligate the uterine arteries per vaginam, but when the uterine packing was removed the bleeding was so profuse that the uterus was repacked and the patient prepared for a laparotomy. Operation: hysterectomy. The patient was transfused before and after the operation, but developed peritonitis and died on the eighth

postpartum day. (I am indebted to Dr. Sam Abrams of St. Louis for allowing me to report this case.)

CASE 3.—Patient, aged thirty-six, gravida 12. Had four living children, two premature labors at six months, and seven abortions (none induced). Patient and husband both had negative Wassermanns. During the last three months of her pregnancy the patient had almost constant uterine pain and irregular uterine contractions, and on two occasions went to the hospital thinking she was in active labor. On April 25, 1932, she reentered the hospital with a history of having had irregular contractions all night. Upon examination it was found that it was a breech presentation and vaginal examination revealed two finger dilatation. At 9:15 A.M. a hypodermic of 2 mm. of infundin was given. This increased the contractions, for a short time and the dose was repeated in one hour. This last injection was followed by very active contractions and in twenty minutes the membranes ruptured. When the patient arrived in the delivery room one foot and the cord had prolapsed. Under ether a living child was delivered easily. Repeated efforts with Credé's method failed. A manual removal was then decided upon, but when an attempt was made to remove the placenta, no definite line of cleavage was found, and wrongly an attempt was made to remove the placenta piecemeal. Immediately very copious hemorrhage resulted, and the uterus was packed, the patient given 750 c.c. of citrated blood and returned to bed. For several hours the patient showed evidence of shock but when these symptoms subsided she was taken to the operating room and a supravaginal hysterectomy was performed (both tubes and a cystic right ovary were removed at this time); 750 c.c. of blood was again given following the operation, and the patient showed no shock after returning from the operating room. She made an uneventful recovery and left the hospital on the twelfth day.

Examination of the uterus showed the endometrial surface was ragged and irregular, and in one portion was attached a large shaggy mass of placental tissue which represented the remains of the placenta accreta.

Histologic examination showed at the junction of the villi and the uterine muscle, only a small amount of decidual tissue and no spongy decidua anywhere. In many areas, only a thick layer of fibrin was interposed between the villi and muscle. The uterus away from the placental site showed a few decidual cells and underlying them considerable blood. With O. V. stain, the intima of the vessels was seen to show early edematous changes.

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634 NORTH GRAND BOULEVARD.

#### ABSTRACT OF DISCUSSION

DR. FREDERICK H. FALLS, CHICAGO, ILL.—I have seen three of these cases. The first one was in consultation on about the eighth day of the puerperium with the patient almost exsanguinated from a continuous dribbling of blood. Attempts had been made after delivery to remove the placenta but they were only partially successful. Because of the anemia of the patient and some fever, I rather hesitated to open the abdomen. I transfused her and then removed about one-third of the placenta vaginally with an ovum forceps and the hand. The patient recovered.

Practically an identical case occurred in our clinic at the Research Hospital. The placenta was removed successfully with the hand several hours after delivery. The uterus was packed and the patient recovered.

In spite of the fortunate outcome in those cases, I feel, with Dr. Dorsett, that the radical treatment is the one of choice if after an attempt at removal it is felt that the placenta is too adherent or that it has not been completely removed, or if the patient bleeds following the packing of the uterus after it is thought that all of the placental tissue is removed. I think we are inclined to be too conservative about removing the uterus under these conditions. We are inclined to wait too long and let the patient bleed, become anemic and possibly develop a sepsis. Then when we decide that the uterus should be removed, conditions have developed which make hysterectomy extremely dangerous.

It is not always easy to differentiate between different degrees of adherence of placenta accreta. At the Chicago Lying-In Hospital, a resident found that the patient had a very adherent placenta, which he could not deliver by the usual methods. He inserted his hand into the uterus and found a very adherent mass. Finally he loosened it and on withdrawing his hand he found to his surprise that he had done a submucous myomectomy.

When placenta accreta is diagnosed or suspected an immediate determination by intrauterine manual exploration is indicated, followed by hysterectomy in all cases where insuperable difficulty is encountered in the removal of the placenta and this before severe postpartum hemorrhage or sepsis has increased the risk to the patient.

DR. FOSTER S. KELLOGG, Boston, Mass.—I have happened to be associated in one way or another with perhaps twelve or thirteen cases that have been diagnosed as adherent placenta. In my experience, the pathologists' reports have not been definite nor so satisfactory and I would like to raise this question in connection with the subject: Speaking broadly, there are clinically two distinct types of placenta accreta, one in which the placenta may be largely clawed off, and with or without packing the patient survives. The remaining pieces slough off, provided enretage is not resorted to, in about twenty-one days, or they come away in a puslike lochia and are never recognized. In the other type the patient may be saved only by hysterectomy. Dr. Mallory studying both of these varieties in the pathologic laboratory invariably sends back the same report on the one or the other specimen. In other words, translating his pathology into our clinical observation, it is purely a qualitative matter. I hope further pathologic study will reveal some quantitative rather than qualitative differences.

DR. BETHEL SOLOMONS, DUBLIN, IRELAND.—I feel that obstetricians who have a large experience make very clear the fact that placenta accreta is an extraordinarily rare condition because I find that junior obstetricians seem to think that it is a very common thing from reading a few cases reported.

One point that has been made clear is the differentiation between placenta accreta and adherent placenta. If a junior tells me that he has an adherent placenta in a primipara, I do not believe it. I have never seen such a thing. I have seen *placentas* that have been called adherent and I always find them to be simply retained placentas. In the last 50,000 labors at the Rotunda Hospital there has been no case of placenta accreta, so I think it may be taken as a very rare condition, in Ireland at any rate. However, I had a patient during the last two months upon whom I operated. It was that of a woman doctor who was having an operation outside the hospital. She was one of those patients who, in the absence of anything pathologic had had a dead baby in her first confinement. A complete routine examination was made of both the patient and the fetus in an effort to find out why the baby had died. She was a woman of forty-two and after consultation it was decided to do a cesarean section when she came to term. On attempting to remove the placenta it was found that it could not be budged. It was welded to the uterine wall and the attempt was given up because obviously it

would have been necessary to tear large pieces out of the uterine wall. A hysterectomy was performed. It was a true placenta accreta.

DR. ALBERT MATHIEU, PORTLAND, OREGON.—I have among my case reports one of a placenta accreta found at cesarean section and complicated by a breech presentation, a large cyst of the cervix and a cervical stenosis. Because of a breech presentation in a forty-three-year-old primipara with an undemonstrable external cervical os and a large cervical cyst, I started a classical cesarean section. A baby weighing 4285 gm. was extracted. Upon attempting to remove the placenta it was found to be growing into the myometrium and attempts to wipe it loose with a towel were of no avail. At each effort masses of placental tissue were left attached to the uterus. As considerable blood was being lost during the procedure, a rapid supravaginal hysterectomy was performed. The pathologic examination showed that the placental substance had apparently grown directly into the uterine tissue. A number of fibrous infarcts were present about the borders of the placental substance, and they also had a very close contact with the uterine wall. Cut sections through the placental substances showed it to be apparently normal.

Section through the placenta and uterine wall showed no distinct line of separation. The covering of the placental villi was continuous with the connective tissue stroma of the uterine musculature. Some of the decidual cells were in the formation of islands which were entirely surrounded by uterine muscle.

DR. JAMES E. DAVIS, ANN ARBOR, MICH.—The pathology of this condition undoubtedly involves changes in blood vessels and blood spaces. The myometrium fails to normally limit the advance of the chorionic villi, and there follows a narrowing or thinning of the myometrial wall. Two grades of attachment of the placenta and myometrium can be described. Grade one can be considered somewhat akin to a diphtheritic type of infection. This type of infection would glue the placenta to the uterine wall but it would be possible to peel off the placental tissue, leaving a bleeding surface. In the second grade, because the blood supply has been destroyed and because the chorionic villi have advanced far into the myometrium, there is no possibility of separating the placenta from the myometrium. Here is the genuine type of inseparable placenta accreta.

In the first grade of attachment low grade infection may play a part in the adhesive process.

DR. RAYMOND A. D. GILLIS, PITTSBURGH, PA.—I should like to report my experience with one case. The patient came to the Mercy Hospital in Pittsburgh with a history of having been treated by a large dose of radium five years previously at the same institution. After the radium treatment she had not menstruated, so far as the history was obtainable. She was admitted to the hospital suffering from considerable abdominal pain and uterine discharge for weeks. She presented a mass in the abdomen about the size of a four or five months' pregnancy. There was some fever, the mass was tender and there was a foul discharge from the vagina. A diagnosis of pregnancy could not be made either by bimanual or abdominal examination and only with x-rays could the fetus be shown and its position determined. She had been in labor and having ineffectual contractions for a period of a week. By this time the uterus was infected and the membranes ruptured. It was possible to move the fetus around so that a foot could be brought through the cervix and finally a macerated fetus was delivered. Following this the placenta showed no sign of separation from the uterine wall, and it was concluded, on account of the previous radium treatments, that she probably had considerable atrophy, if not entire absence, of the decidua and possibly had a placenta accreta. No attempt was made on this account to remove the placenta from below and an immediate hysterectomy was recommended. The patient declined this operation and was sent back to the ward. Some days later the placenta was found to

be intact and, apart from developing a certain amount of cellulitis, the condition cleared up in a few weeks without any ill effects.

DR. ARTHUR J. SKEEL, CLEVELAND, OHIO.—For the last five years it has been our custom not to invade the uterus for a retained placenta. If the placenta is not expressed in a couple of hours the patient is put back to bed and not disturbed for eighteen to twenty-four hours, and in that time we have never failed to express the placenta readily without invading the vagina. I take it from the pathology of the placenta accreta that there should be no immediate hemorrhage. I am wondering what the indication was for removing the placenta manually and whether in the process of our usual procedure of letting the patient go back to bed for twenty-four hours if she had a true placenta accreta, would there be risk of hemorrhage?

DR. DORSETT (closing).—I feel that one of the etiologic factors in placenta accreta is the fact that a previous dilatation and curettage has been done. I am sure we all have reports returned from the laboratory that the tissue contained decidua plus uterine muscles; which proves that we have been a little too energetic in our curettements either for retained placental tissue or for diagnostic curettage.

Dr. Kellogg has brought out an interesting point in regard to the two types of placenta accreta and I feel that there is a difference of degree in the penetration of the villi. In some cases they may only penetrate a very short distance, and in other cases which have been reported, the pathologic specimens have shown where they have penetrated entirely through the muscularis of the uterus and down to the peritoneal coat.

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## ENDOMETRITIS AND PHYSOMETRA DUE TO WELCH BACILLUS\*

FREDERICK H. FALLS, M.D., CHICAGO, ILL.

*(From the Department of Obstetrics and Gynecology, University of Illinois College of Medicine, and Cook County Hospital)*

**P**UERPERAL sepsis due to or associated with the Welch bacillus is relatively uncommon even in the practice of obstetricians of wide experience, and on active obstetric services. For this reason the nature of the infection, its pathogenesis, methods of diagnosis and management are often not thoroughly understood by the medical attendant, and the dangers and responsibilities attending such a case may be overlooked. In order for these factors to be fully appreciated, it becomes necessary to establish in the minds of the clinicians certain fundamental facts that have to do with the bacteriology and pathology of this disease so that intelligent management of a given case may be assured, even though the experience of the medical attendant may be limited in the care of this disease.

Most of the reports in the literature have to deal with individual case reports or small series of fatal cases. Reports from the surgical field also show a high mortality in this type of infection. The sinister reputation thus acquired has so stamped this disease that the clinician on realizing the presence of a gas bacillus puerperal sepsis is prone to give a very

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\*Read at a meeting of the Chicago Gynecological Society, April 15, 1932.

poor prognosis without attempting to base the same on a careful interpretation of the bacteriologic, pathologic, and clinical facts.

Because my experience with this disease has been rather unusual in that none of the cases have proved fatal it occurred to me that a presentation of this phase of the subject might be of service in rounding out the picture of gas bacillus infection in your minds. Moreover, I wish to point out that often the gas bacillus infection is present in certain pnerperal cases and totally unsuspected.

Also, I wish to show that certain clinical phenomena when present should lead to a bacteriologic examination of the vaginal tract, the technic of which is very simple. Finally to emphasize the importance of meticulous care in the handling of these cases to avoid injury to the soft parts that might serve as a portal of entry for the infection into the blood stream or lymphatics.

There was considerable confusion in the minds of the earlier workers in this field due to the fact that a number of different names were applied to the same organism, and also, that the gas bacillus was not obtained from wounds in pure culture which led to confusion regarding its cultural characteristics. It is now recognized that the *Vibrio septique* of Pasteur, *Bacillus Perfringens* of the French, *Fraenkels*, *Bacillus phlegmones Emphysematosae*, *Bacillus emphysematis vaginae*, *Lindenthal*, *Granulobacillus saccharobutyrieus immobilis liquifaciens* of Schattenfroh and Grassberger, *Bacillus aerogenes acrophilis agilis*, *Uffenheimer*, and *Bacillus septique aerofie* of Legres and Leene are all the same organism as that described by Welch and Nuttall in 1892.

The first fact that strikes one on investigating the cause of this infection is that the human intestine and that of all of the domestic animals and rodents contain the organism. Immediately one remembers that most deliveries are attended by the extrusion of fecal material from the rectum late in the second stage of labor.

Even though the small particles of fecal matter are carefully removed as soon as they appear at the anus, bacteriologic contamination of the perineum and vagina is easily conceivable. The gas bacillus is probably a normal inhabitant of the vagina of women who have had a third degree tear or who have rectovaginal fistulae. When one remembers the contamination of the vaginal tract which probably frequently occurs in the most expert hands during a difficult forceps delivery or breech extraction, and which must occur almost invariably in the hands of inexperienced obstetricians during these operations, it is difficult to see why a large percentage of these cases are not exposed at least to the infection. It must follow therefore that only under exceptional circumstances does the gas bacillus produce infection and acquire the invasive power of a true pathogenic organism.

If this were not true there should occur epidemics of this type of infection. Furthermore the severe fulminating types of infection as in

the cases recently described by Toombs should be much more common than they are found to be among puerperal sepsis cases at this time. There is relatively little mention in the literature of the nonfatal types of gas bacillus infection.

The reason for this seems to be that the clinicians either do not appreciate the significance of the presence of gas in the generative tract or they do not appreciate how relatively simple the bacteriologic technic is for the isolation of these bacteria in a given case.

#### PATHOLOGY

According to Welch there are five groups or types of cases.

*Group I.*—In which the fetus or product of conception shows emphysematous infiltration. These cases may show little or no general reaction.

*Group II.*—Puerperal endometritis in which the gas bacillus does not penetrate the uterine wall and the inflammatory reaction is limited to the endometrium. There usually is some general reaction which subsides in a few days and the patient goes on to recovery.

*Group III.*—Physometra or Tympania uteri in which the uterine cavity is distended with gas produced by the Welch bacillus. It has been shown that the colon bacillus and other gas producers never form large amounts of gas in the tissues of any but diabetic patients.

*Group IV.*—Emphysema of the uterine wall is usually associated with tympania uteri and is due to invasion of the wall by the gas bacillus via the lymphatics, K. Bingold. These cases are usually fatal.

*Group V.*—Gas sepsis in which the bacillus invades the blood stream through the blood vessels of lymphatics produce hemaglobinemia, jaundice, bronzing of the skin and later anemia. Nearly all of these cases are fatal.

The detection of a gas bacillus infection is as a rule not difficult if one is alert for the clinical manifestations of the disease and prepared to confirm clinical impression by bacteriologic investigation. The clinical picture varies from no general symptoms at all on the one hand to severe manifestations of a fulminating fatal puerperal sepsis on the other.

Since we are concerned with the milder nonfatal type of infection in this paper, we will confine ourselves to the symptoms seen in these cases.

The first thing that may arouse suspicion in the mind of the attendant regarding the possibility of a gas bacillus infection is the presence of gas bubbles in the vaginal secretions of women aborting or in active labor. This may be the only symptom or sign until the product of conception is passed at which time it will be seen to have gas bubbles on its surface, and in the case of well advanced fetuses there may be marked emphysematous infiltration of the subcutaneous tissues, and especially the "foamy liver." When the condition is more advanced to the stage of puerperal endometritis, there are frequently seen septic

phenomena such as fever, rapid pulse, leucocytosis, chills and nausea and vomiting. The uterus may be noted to be higher than usual, and tympanitic to percussion. The fetal outline will be masked and the uterus may be in tetanic contraction. The whole picture may simulate somewhat that seen in premature separation of the placenta except for the absence of signs of hemorrhage. Gas may be heard or seen escaping from the vagina with a crackling sound and the odor is a peculiar sweetish foul odor which is characteristic and once observed will almost suffice to establish a diagnosis without further investigation. The amount and tension of the gas in the uterus is almost unbelievable in some of these cases. This condition is only seen in women with well advanced pregnancy where the presenting part effectively blocks the lower uterine segment and cervix. In two of our cases on pushing up on the fetus a rush of gas was heard whistling out of the uterus as if a knife had been plunged into a tightly inflated football.

Following delivery in these cases there is usually a febrile reaction for a few days and then an uneventful convalescence. On the other hand the infection may go on to emphysema of the uterine wall, thrombophlebitis, lymphangitis, and fatal septicemia. Not all cases in which the organism has been cultivated from the blood show serious symptoms. According to Bingold one-third of all cases yielding positive blood cultures run an afebrile clinical course. We must explain this on the assumption that these organisms are relatively avirulent and were forced into the blood stream rather than that they gained entrance by their virulent penetrating power; and further that they yielded to the bactericidal power of the blood or the organs to which they are carried. It is probable that in most cases they cannot multiply in the blood stream because of its oxygen content until just before or just after death.

The bacteriologic diagnosis in a case suspected of harboring the gas bacillus is readily and simply made. Two ordinary tubes of litmus milk are poured together so that the resultant tube will be about half full of milk. This is then placed in boiling water for a few minutes to drive off the oxygen. On cooling a cream ring layer of fat will be noticed on top of the milk. This milk is then inoculated by means of a sterile swab or platinum loop dipped in the vaginal secretions; and incubated at  $37\frac{1}{2}^{\circ}$  over night. The next morning the so-called stormy fermentation will have occurred if the gas bacillus is present. This consists of the formation of a large amount of gas in the coagulum of the milk which has turned acid in reaction. In some cases the stoppers are blown out of the tubes. Liquefaction of the coagulum also takes place. Gas bubbles will be seen rising from the bottom of the tube and collected on the surface of the media. From the milk, smears are made and rather heavy gram-positive rods can be seen. Capsules can be demonstrated by special stains. A few cubic centimeters of the culture injected into the ear vein



of a rabbit are allowed to circulate for a few minutes and then the rabbit is killed and placed in the incubator for twenty-four hours. Autopsy shows the rabbit enormously distended with gas and what is most characteristic the so-called "foamy liver." This appearance is due to numerous gas bubbles that arise from the fermentation of the glycogen in the liver cells. Smears from the rabbit's tissues reveal the capsulated organism.

The clinical material upon which these observations were based was studied at the Cook County Hospital, University of Iowa, and at the University of Illinois Research Hospital. The patients were all charity patients and all were white women. Two of the series were at or near full term and had had labor pains for several hours with ruptured membranes and prolapsed cord. The other four were abortions in the early months. The details of the case histories are of interest and of some importance because of their bearing on the clinical management.

CASE 1.—Primipara twenty-two years old, Polish, had been in labor about fourteen hours when admitted to the Cook County Hospital about 6 A.M. one morning. She had been attended at her home by a midwife who made repeated vaginal examinations and who, when the membranes ruptured and the cord prolapsed, called in two doctors. They in turn tried to replace the cord and deliver the woman by version without success. The patient was then told that she would have to go to the County Hospital for delivery. She got up and dressed, and with the cord hanging down to her knees, boarded a street car and came about eight miles across town to the hospital. On admission the patient was prepared obstetrically. The pulseless discolored cord was disinfected as carefully as possible and cut off at the vulva. On vaginal examination the cervix was found to be about four centimeters dilated, pains rather weak and coming about every five minutes. A Voorhees number five bag was inserted and weight attached. This started good pains and the bag was expelled about 5 P.M. at which time nearly complete dilatation was present. On examination a hand and arm were found prolapsed in the vagina.

A sweetish foul odor was noticed but not correctly interpreted. Gas bubbles were noted in the vagina but still the diagnosis was unsuspected. It was decided to try carefully a podalic version to determine how tightly the uterus was clamped down on the child. On pushing up on the shoulder a large quantity of gas escaped with a whistling sound audible all over the room and filling the latter with the characteristic sweetish foul odor. I then made a tentative diagnosis of Welch bacillus infection and at the same time decided that version was too dangerous to attempt. The only alternative was decapitation, the prospect of which was anything but inviting because I realized fully the consequences of injury to the maternal soft parts, and implantation of gas bacilli into wounded smooth muscle. However, by careful manipulation of the Braun blunt hook over the neck and using a heavy blunt cleidotomy scissors to cut through the soft parts, I was able to decapitate and remove the fetus which was emphysematous throughout and from whose tissues the Welch bacillus was recovered in smear and culture. The next morning her temperature was 105.4° and she was tender over the lower abdomen and showed all the signs of a severe puerperal sepsis. My prognosis in the light of what I had read regarding gas bacillus infection was absolutely bad. I was greatly surprised to find her slightly improved the next day and temperature free on the sixth day. She left the hospital on the fourteenth day with no sign of residual pathology.

CASE 2.—Para iii, who, when first seen by me, was completing a three months' abortion. She was on the delivery bed at the Cook County Hospital, and there was no thought of infection in connection with the case in the minds of the attendants.

The history revealed that the abortion had been self induced by inserting into the cervix a piece of slippery elm which the patient had carried around in her pocket-book for two years. This had been done about twenty-four hours before and had resulted in some hemorrhage and the onset of uterine cramps. The patient had no fever and no evidence of septic reaction. On making suprapubic pressure to see whether the product of conception could be expressed, gas bubbles were noted coming from the vagina along with a small amount of bloody secretion. Culture taken in litmus milk showed stormy fermentation and gave the characteristic findings when injected into a rabbit.

The clinical course was absolutely symptom free as regards temperature, pulse, pain, and tenderness, and she left the hospital on the eighth day.

CASE 3.—Almost a duplicate of Case 2 except for a slight fever 100.4° and leucocytosis. Attention was called to the possibility of a gas bacillus being present by the gas bubbles present in the fetus and placenta after expulsion. The abortion was spontaneous at the fourth month and no definite history of interference was obtained from the patient. The temperature came down to normal the next day after the abortion.

CASE 4.—Twenty-two-year-old primipara, three months pregnant, entered the clinic of the University of Iowa with a temperature of 102.4°, pulse 120. She was having severe cramps and was flowing slightly. According to her history, a doctor had induced the abortion by introducing a stick of slippery elm into the cervix four days before. Issuing from the vagina was a bloody discharge which contained gas bubbles, and which gave the characteristic sweetish foul odor. The whole fetus was blown up with gas when extracted. Gram stain of the fetal tissues showed a gram-positive organism and cultures and animal inoculations showed the typical Welch bacillus. The day before entry to the hospital, she had several severe chills and fever. On examination the whole abdomen was rigid and there was marked tenderness in both lower quadrants extending to McBurney's point on the right. There was a tender firm mass in the midline of the abdomen extending to within two fingerbreadths of the umbilicus taken to be the uterus. No fetal movements or heart tones could be elicited. On rectal examination the slippery elm stick could be felt in the cervix, and on pulling on a string protruding from the vagina the stick came out of the cervix. It was about three inches long and a fourth of an inch in diameter.

The patient was transferred to the contagious hospital. Her temperature came down to normal on the fourth day and she made an uneventful recovery.

CASE 5.—Thirty-seven-year-old para ix, pregnant two months, who entered the clinic of the University of Illinois because of a severe heart lesion. The heart was partly decompensated. She was admitted July 2 and was treated for her cardiac decompensation until July 30 when she went into labor spontaneously and aborted in about one hour. There was no history of vaginal examination before she started to abort, and she was in the hospital under observation for twenty-eight days before the abortion started. The possibility that she examined herself vaginally is to be considered. When the fetus was expelled it was found to be emphysematous. This led to culture and smears and animal inoculation which revealed the gas bacillus. She had no temperature previous to or following this abortion and left the hospital the tenth day with no evidence of residual pathology.

CASE 6.—Para i, thirty-three years old, entered the ward September 30, 1931, at 12:15 A.M., with the history that the membranes had ruptured prematurely and

that the cord had prolapsed immediately. The cord was not pulsating but the resident attempted unsuccessfully to replace it in the uterus. The baby was in transverso presentation and an arcuato typo of bicornuate uterus was diagnosed. An attempt was made to substitute a breech for the transverse presentation. Pains started about 8 P.M., twenty hours after admission and became strong the next morning. The cervix dilated slowly and at 1 P.M. an arm prolapsed. On examining the patient, I found the uterus to be ballooned up and very tense. The pains were strong and tetanic in character. There were some bubbles of gas escaping from the vagina on rectal examination. The temperature was  $101.8^{\circ}$  and the pulse 144. A diagnosis of physometra and gas bacillus infection was made and under deep ether anesthesia version gently attempted. On pushing up the shoulder explosive expulsion of a great quantity of sweetish foul swelling gas occurred. Because version could not easily be accomplished and because of our success with Case 1, it was decided to do a decapitation following the same technique. This was accomplished without apparent injury to the uterus or vagina and the baby slowly and gently delivered. Typical emphysema of the tissues of the baby was revealed. The temperature dropped to  $100.4^{\circ}$  the next day and to normal on the third day. She left the hospital on October 11 with no evidence of residual infection. The gas bacillus was proved by smears, cultures, and animal inoculation.

An analysis of these cases would seem to show that the gas bacillus may be present in certain cases without giving any striking clinical evidence of its presence. This it seems to me is an important point from the standpoint of unsuspected contamination of our birth rooms and maternity wards. It would seem, however, that there is little danger of starting an epidemic of this type of puerperal sepsis as there seems to be no mention of such in the literature.

The first, fourth, fifth, and sixth cases are examples of physometra and the infection was apparently limited to the fetus and the endometrium. This was evidenced clinically by the failure to develop the hemoglobinuria, hemoglobinemia, and the bronzing of the skin. Unfortunately blood cultures were not made in any of these cases, but according to Bingold they are positive in one-third of such cases. A positive or negative culture would have had little clinical significance. A complete bacteriologic study of the secretions for mixed infection also was not made except that the smears from the fetal tissues, milk cultures, and animal inoculations showed an overwhelming preponderance of the *Weleh* bacillus. This work confirms the experience of Schottmuller, Bingold, Brütt and others of the preponderance of the cases in infected abortions and in patients with prolapsed cord especially where operative intervention has complicated the labor. It would also seem to confirm the opinion of Weleh and others that the organisms are largely saprophytic unless they are implanted upon devitalized tissues, and it may be that secondary invaders such as the *Streptococcus putridis* or colon bacillus are necessary to enhance their virulence.

I feel that it should also be pointed out in this connection that in spite of the fact that it has been shown that the organism can produce inflammatory changes it has not as yet been shown that it fulfills Koch's laws

with respect to the disease. Furthermore its lack of pathogenicity for lower animals is shown by the fact that it is necessary to kill the inoculated rabbits in order to get the organism to grow and produce the characteristic tissue changes. Practically all of the fatal cases reported in which careful bacteriologic examination was carried out showed a mixed infection often with a streptococcus concerning whose virulence there is no reasonable doubt.

Our treatment of these cases was the routine for any infected puerperal case. The head of the bed was elevated, fluids pushed, and one dram of fluid extract of ergot was given four times a day for three days. Serum was not available for the first five cases and was not given in the last case because the clinical course was so benign at the time when the serum was obtained.

TABLE I. RESULTS OF VAGINAL CULTURES

SOURCE	POSITIVE	NEGATIVE	TOTAL	PER CENT POSITIVE
<i>Research and Educational Hospital:</i>				
Prenatal Dispensary	7	138	145	4.82
Gynecological Dispensary	5	10	15	33
<i>Cook County Hospital:</i>				
Incomplete Abortions	5	17	22	29.41
Prenatal Dispensary	8	104	112	7.69
Gynecological Hospital Cases	8	68	76	11.76
<i>St. Vincent's Hospital:</i>				
Prenatal Dispensary	0	13	13	0
Totals	33	350	383	8.61

In order to determine something of the frequency of the gas bacillus in the vagina of prenatal, puerperal, postabortal, and gynecologic cases, a survey was made at the Cook County, Research Hospital and St. Vincent's Home. Gram stain and the reaction in litmus milk were used to denote the presence of the gas bacillus. A few of the cultures found to be positive by these tests were run through rabbits. The results shown in Table I, indicate that the gas bacillus is present in prenatal cases in the smallest number, next in gynecologic cases and most frequently in the infected abortions. This corresponds well with the work of Mouchette who found the bacillus perfringens in 13 out of 18 cases of abortions between the second and fifth month.

Jeannin found 12 positive cultures out of 18 similar cases and 2 of these patients died. In 1 patient there was no fever, in 3 the temperature dropped from 104° to normal as soon as the uterus was emptied, while 2 had a sudden drop to normal after a preliminary rise. He had 3 cases of physometra, 2 patients died.

Rist and Mouchette report 3 cases of infected abortion with very high temperature, but with eventual recovery.

Little reports 9 cases of Welch bacillus infection of the uterus which occurred at Johns Hopkins Hospital, 2 of which were previously reported by Dobbin. Seven of the 9 patients recovered and in most of the details were comparable with my cases. He states however, that no one had cultivated the gas bacillus from the normal vagina up to 1905.

### CONCLUSIONS

1. The gas bacillus of Welch is relatively common in septic abortions.
2. Gas bubbles in the vagina of women aborting or in labor should lead to an investigation for the gas bacillus.
3. Its detection and isolation requires only a very simple bacteriologic technic.
4. When diagnosed, these infections should be handled with the greatest care to avoid wounding the soft parts.
5. Such cases should be handled with strict isolation technic during their stay in the hospital.

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1819 WEST POLK STREET.

## PUERPERAL SEPSIS: B. WELCHII, FATAL TYPES\*

A. F. LASH, PH.D., M.D., CHICAGO, ILL.

(From the Department of Obstetrics and Gynecology, University of Illinois, College of Medicine and the Cook County Hospital)

THAT type of puerperal sepsis due to the *Bacillus Welchii*, (*Bacillus perfringens*, *Bacillus aerogenes capsulatus* or Frankel's bacillus), which is usually fatal, is uncommon. When it does occur, the importance of making an early diagnosis and to determine the clinical type in order to intelligently treat the condition, warrants further emphasis and repetition of its characteristic clinical course. Another reason for presenting this paper is the interesting blood chemistry and renal changes observed in two patients who died as a result of this infection, one early and one late.

Wrigley, having observed six fatal cases of puerperal sepsis due to *Bacillus Welchii* out of a total of sixteen puerperal sepsis deaths from 1922 to 1927 at the

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St. Thomas Hospital, London, was stimulated to study the incidence of these organisms in normal and pathologic pregnancies, labors, and puerperiums. He reported his results in 1930, which were as follows: In 50 women cultured at the beginning of labor, no *Bacillus Welchii* was isolated. In 100 women with normal pregnancy, labor, and puerperium no *Bacillus Welchii* was found in the lochia. Therefore, from the literature he reviewed and from his investigations he concluded that *Bacillus Welchii* was not present in the cervix before or in the lochia following delivery, in cases in which the pregnancy, labor, and puerperium were normal. However, Schottmüller claims that it may be occasionally found in the vagina of normal, healthy women and that autoinfection is possible.

Wrigley also studied 69 women with abnormal pregnancies, labors, or puerperiums. In this series he was able to isolate the *Bacillus Welchii* from the lochia of 13 patients. Four of these developed a generalized gas bacillus infection. Yet in 16 patients, in whom violent efforts to deliver the child were made, there were no uterine infections with pathogenic anaerobic organisms. Therefore, he concluded that certain conditions must be present for severe maternal infection to occur, such as: The organisms must be introduced into the uterus; the organisms must find there suitable material, namely, dead tissue on which to grow; the infected tissue or fetus must remain in the uterus for a sufficient length of time; and finally, the damaged maternal tissues must be exposed to the infection provided in this manner.

Lehmann and Fraenkel reported in 1924 that they found the gas bacillus in 106 cervical cultures of 580 abortions. There was no further propagation of these organisms since no clinical evidence of infection occurred. In 18 gas bacillus bacteremias, the organisms were found in the blood in 14 instances following curettage, in 2 instances after chills, and in 2 after a rise in temperature.

In a series of 41 puerperal septicemias due to the *Bacillus Welchii* collected from the literature, Toombs and Michelson made the following bacteriologic observations: The organism was found in the uterus in 19 of the 41 patients. It occurred alone in 9 cases, with *Staphylococcus aureus* in 3, with *Staphylococcus albus* in 1, with streptococcus in 1, with *Streptococcus pyogenes* in 5, with anaerobic streptococcus in 1, and with *Bacillus coli* in 5. From the blood *B. Welchii* was isolated in 16 cases being associated in single instances with typhoid bacillus, anaerobic streptococcus, staphylococcus, pneumococcus, and *Bacillus coli*.

Although Toombs and Michelson collected 190 cases, they selected only 41 cases of puerperal septicemia (*Bacillus Welchii*), for analysis. From this clinical data they contributed the following facts: 61 per cent of the total number of cases were abortions; the nonabortion group (39 per cent) had many causes for prolonged labor which were active in the first stage in 95 per cent of the cases. The obstetric conditions producing the prolonged first stage also required frequent vaginal examinations and operative procedures. These factors well explained the exogenous source of the bacteria and the favorable conditions for their growth induced by the intrauterine and vaginal manipulations. Therefore, these statistics bear out Wrigley in his conclusions.

The pathology produced by the organism in the puerperal uterus were emphysema of the fetus, puerperal endometritis, physometra, emphysema of the uterine wall and gas bacillus septicemia. If the process remained localized to the ovum or the endometrium and was well walled off, the symptoms were slight and the patient usually recovered even though the organism was found in the blood stream. Serious consequences followed the entrance of the organism into the uterine musculature. Here it grew in the lymph spaces between the muscles and in the lymph spaces

of the vessels because of their poor content of oxygen. Necrosis of the tissues in their neighborhood resulted. Around these areas of necrosis, there was a peripheral edematous zone due to the extravasation of the blood from the necrotic vessels and its subsequent hemolysis by the hemotoxin. Polymorphonuclear leucocytes were repulsed by a leucocidin liberated by the *Bacillus Welchii*. Through the lymph stream the organisms were discharged to give rise to the picture of gas bacillus septicemia. The bacteria did not multiply in the blood because of its oxygen content but might do so just before death when the oxygen content was greatly diminished as the circulation was failing. Lehmann laid much stress on the renal changes as a cause of death. He believed that the kidney obstruction due to the end-products of the broken-down hemoglobin was a factor. However, Fraenkel believed that the gradual cessation of urinary secretion might be a contributing cause. This mechanism was first described by Cohnheim in 1880. He further stated that gas bacillus infection could occur only in organs or structures having smooth or striated muscle elements and that when gas was found elsewhere it was usually carried there by the blood vessels.

The clinical course of the severe or metritic type of *Bacillus Welchii* infection begins with early characteristic symptoms. In the 41 puerperal septicemias, the prodromal period was found to occur within forty-eight hours of the inoculation in 70 per cent of all cases and within twenty-four hours in practically 50 per cent. The chief symptoms observed in these patients were pain in the lower abdomen, especially in the abortive group, vomiting, diarrhea, jaundice, or bronzing of the skin with cyanosis, dyspnea with even air embolism symptoms. The jaundice and cyanosis were present in a large percentage of the patients, as early as twenty-four hours after the onset and as late as the eighth day. Emphysema of the skin occurred in only 16.59 per cent of the cases and in only 4.74 per cent of these the emphysema was generalized.

The characteristic observations were: fever, usually high, accelerated pulse, rapid respirations, tenderness over the uterus, and bloody vaginal discharge which was foul in some cases. The urine was usually scanty, brownish red with much debris. Complete examination of the urine disclosed albumin, hyaline and blood casts, methemoglobin, oxyhemoglobin, hematoporphyrin, and hematin. The blood picture showed a marked decrease in the red blood cells and hemoglobin, with an increase in the white blood cells. Lehmann and Fraenkel observed that the red blood cells dropped from 4,200,000 to 2,100,000 and the hemoglobin from 70 per cent to 30 per cent in the course of six hours. The blood serum had a cherry red color and methemoglobin, oxyhemoglobin, and hematin were demonstrable.

Heim emphasized the presence in the blood of pathologic bone marrow cells which he claimed could be observed only in pernicious anemia and gas bacillus sepsis. This association of these two diseases has given rise to experimental studies as those

of B. S. Cornell and Barach and Draper, to determine the possible cause of pernicious anemia in the form of a chronic intestinal gas bacillus infection.

Although Fraenkel maintained that the hemolysis of the red blood cells producing the jaundice was due to the absorption of the toxic products from the necrotic tissues, Ford and Lawrence showed that the hemotoxin liberated by the *Bacillus Welchii* was the cause of this hemolysis. Their contentions were supported by the work of others (Cornell, Barach and Draper).

The diagnosis could, therefore, be made early on the basis of the history (abnormal labor or abortion), characteristic symptoms and signs. Toombs stated that jaundice which appeared early and progressed rapidly, occurred only in the puerperal infection caused by the *Bacillus Welchii*. The writer has seen several patients with severe hemolytic streptococcus septicemia present a similar appearance. However, the other characteristic (urinary and blood) changes were absent. The lack of these hematologic and urinary observations would also differentiate drug intoxication, acute yellow atrophy and blood dyscrasias from a gas bacillus infection.

The case histories of the patients observed by me are briefly as follows:

CASE 1.—V. W., a white woman, aged twenty years, entered the Cook County Hospital, December 24, 1926, because of sudden profuse vaginal bleeding which began that morning after some housework, and continued at intervals through the day. She considered herself about six weeks pregnant. She denied that any attempts to abort her were made. Physical examination revealed a young woman, not appearing acutely ill, with a bluish, coppery colored skin, temperature 101° F., pulse 128, and respiration 36. The essential observations were tenderness over the lower abdomen and vaginal bleeding. The cervix was soft, dilated one centimeter; the corpus somewhat enlarged, up and free; the adnexa were free. The urine was black, foul, contained much debris, and gave a strongly positive reaction for albumin. The same observations were present on repeated examinations. The blood picture was R.B.C., 1,050,000; W.B.C., 16,600; hemoglobin 40 per cent. The Wassermann reaction was negative. The blood chemistry determinations were:

	UREA N.	UREA	CREATININE
December 26	97.00	207.58	5.00
January 3	200.00	428.00	24.00
January 7	305.00		14.32
January 8	238.00		20.00
January 21	98.00	208.00	5.00
January 22	206.00		6.79

Bacteriologic study of the uterine secretions and urine revealed *Bacillus Welchii*. Blood culture was sterile.

The patient remained fairly comfortable, the color of the skin becoming lighter. The temperature varied from 97° F. to 102.6° F. for four days and then became normal. The patient vomited once daily and urinated only a small amount each day. Although recovering from the infection, she became weaker and on the thirtieth day in the hospital she became restless, irrational and then passed into a comatose condition and died.

No autopsy was permitted but with the aid of the pathologist and undertaker, a kidney was obtained for study. Microscopic examination of sections stained with



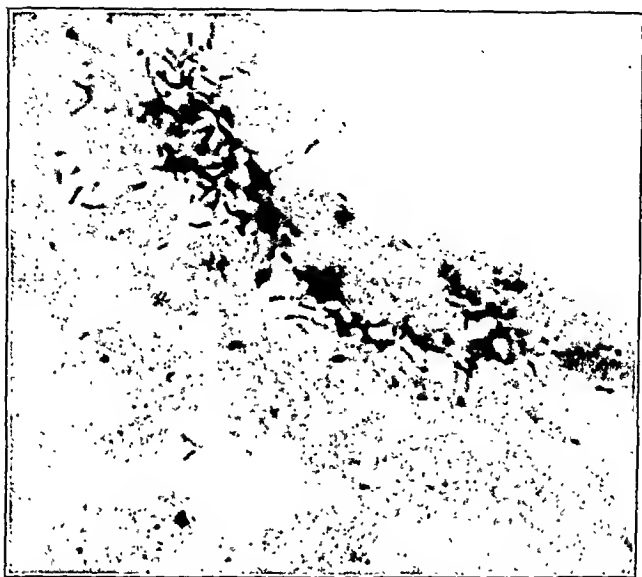


Fig. 1.—Photomicrograph of liver, Case 2, illustrating the *Bacillus Welchii* in the necrotic liver cells at the edge of a gas bubble. Death seventy-two hours after onset of infection.  $\times 450$ .

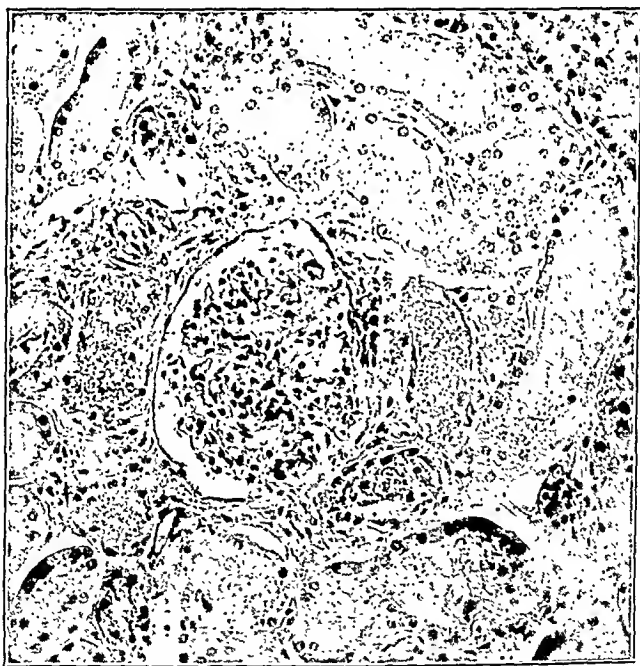


Fig. 2.—Photomicrograph of kidney, Case 2, illustrating the necrotic convoluted tubules, the hemoglobin masses in the tubules and the normal glomerulus.  $\times 140$ .

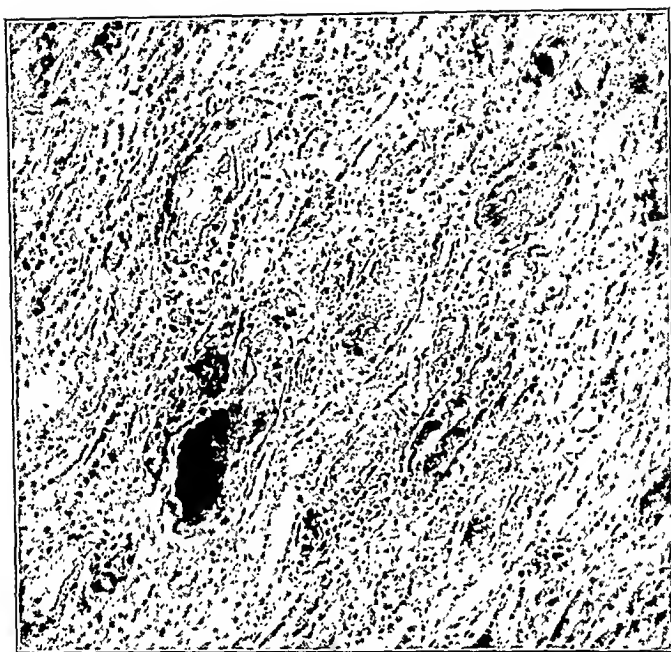


Fig. 3.—Photomicrograph of kidney, Case 2, illustrating the hemoglobin masses in the collecting tubules.  $\times 180$ .

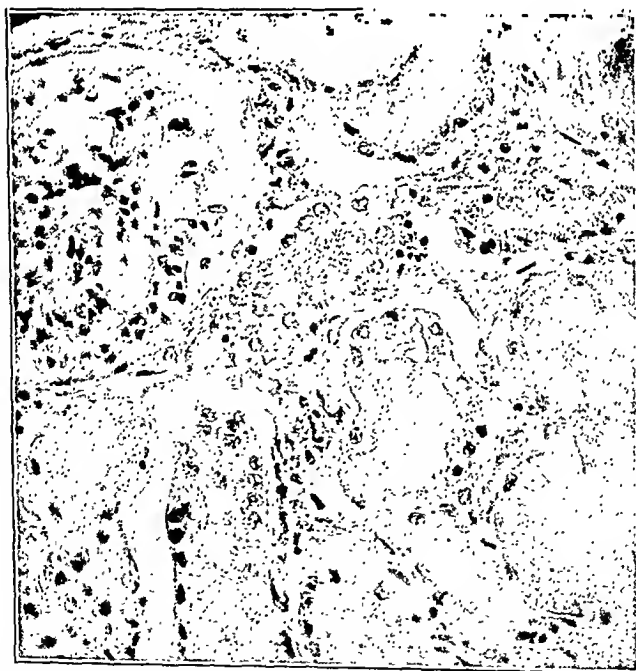


Fig. 4.—Photomicrograph of kidney, Case 1, illustrating the regenerating convoluted tubules with low syncytial-like epithelium. Death one month after onset of infection.  $\times 370$ .

hematoxylin and eosin show no morphologic change in the kidney as the tubules had regenerated, but a suppurative pyelitis was demonstrated.

CASE 2.—T. H., a white woman, aged forty, gravida viii, entered the Cook County Hospital, March 2, 1931, because of pain in the lower abdomen for two days, vaginal bleeding, chills and fever for one day. Having missed her last menstrual period, she attempted to abort herself with a catheter on March 1, 1931. Physical examination revealed an acutely ill middle aged woman whose skin was a dark copper color and whose temperature was 103° F., pulse 120 and respiration 24. The mucous membranes were cyanotic. The essential observations were, marked tenderness in the lower half of the abdomen, soft, patent cervix, and slightly enlarged corpus. A soft mass was felt in the cervix and under sterile precautions it was removed.

The urine was dark brown and gave a 4-plus reaction for albumin and microscopically showed many white and red blood cells, debris but no casts. The blood count on March 3 was: hemoglobin 70 per cent; R.B.C. 3,350,000 and W.B.C. 42,250. On March 4 the R.B.C. sank to 1,750,000. Blood smears showed 92 per cent neutrophils, a shift to the left of over 40 per cent with vacuolization of the polymorphonuclear leucocytes and monocytes. Vacuolization was not confined to the older cells but appeared in the metamyelocytes.

Spectroscopic examination of the urine showed neutral methemoglobin and oxyhemoglobin. Blood plasma showed oxyhemoglobin.

The cervical culture yielded *B. coli*, hemolytic streptococci, and *B. Welchii*. The placental tissue showed the same bacteria on culture. Blood culture yielded only *B. Welchii*. A rabbit was injected with the cervical culture, killed and then incubated. A generalized emphysema developed together with a characteristic foamy liver. The blood chemistry showed a nonprotein nitrogen of 80. The clinical course of this patient was characterized by high fever, rapid pulse, marked respiratory difficulty, and anuria until death, forty-eight hours after admission.

The necropsy was performed by Dr. R. H. Jaffe who found essentially: suppurative endometritis and right salpingitis; diffuse fibrinopurulent peritonitis; septic tumor of the spleen; cloudy swelling, icteric discoloration and gas formation of liver; cloudy swelling and bloody discoloration of the kidneys; gas formation in the myocardium, emphysema of the lungs; parenchymatous hemorrhages; gas bubbles in the subcutaneous tissue.

CASE 3.—I. M., a white woman, aged twenty-one years, gravida iii, entered the Cook County Hospital, March 19, 1932, in an extremely toxic condition, being irrational and disoriented. Her history as obtained at a later date was briefly as follows: On March 15, 1932, she inserted a slippery elm stick because she had not menstruated since January 5. Vaginal bleeding began two days later (March 17). Lumbar and abdominal pains associated with nausea and vomiting occurred on March 18. Chills and fever was experienced and the bronzing of the skin began on March 19. Physical examination revealed an extremely jaundiced young woman with cyanosis of the nose, finger and toe tips. The temperature was 104.4° F., pulse 120, respiration 24, and blood pressure 128/74. The tongue was dry and coated. Eye ground examination showed a marked cyanosis of the retina. The chest examination revealed no pathology. The abdomen was flat, firm, and elastic with tenderness over the lower part. Vaginal examination found the cervix soft, patent, down and back; the corpus was enlarged to the size of a six to eight weeks' pregnancy, tender, soft upright and free; the adnexa were not palpable or tender; speculum examination revealed the patent cervix from which exuded dark blood. Smears were made of this cervical secretion and the gram-positive rods of *Bacillus Welchii* were seen. The urine and blood were immediately examined and the typical cherry red serum and urine were observed.

The diagnosis was made of: Puerperal sepsis, acute metritis, septicemia, *Bacillus Welchii*.

Treatment was then immediately started. Complete laboratory results were: Cervical culture revealed *Bacillus Welchii*, *Staphylococcus albus*, and an indifferent streptococcus; blood cultures taken at different times were sterile.

*Urinalysis:*

	Color			Acetone 4-plus	Blood 4-plus
3-19-32	Red wine				Much debris
3-20-32	Red wine	20 c.c. in 24 hours			
3-30-32	Straw	340 c.c.	1.010	Albumin 4-plus	Blood 2-plus
4- 3-32	Straw	2140 c.c.	1.010	Albumin 2-plus	Blood 0
4- 9-32	Straw	1700 c.c.	1.010	Albumin 1-plus	

*Blood Examination:*

	Hemoglobin	R. B. C.	W. B. C.	Polymorphonuclears
3-19-32	65%	5,200,000	46,300	83%
3-20-32	70%	4,910,000	35,600	
3-30-32	70%	3,250,000	13,400	
4- 3-32	50%	3,110,000	11,600	
4- 9-32	55%	3,010,000	8,950	

*Blood Chemistry:*

	Urea N.	Creatinine	Sugar	CO <sub>2</sub>	Lactic Acid	Chlorides
3-19-32	38.29	2.25	64			
3-20-32	86.38	9.2	106			
3-30-32	214.00	17.14	150	74		
4- 4-32	168.12	21.4		30		
4- 9-32	82	3.5	115	52		
				36	26.0	480.0

The above results were only the essential ones given to demonstrate the great changes occurring. A detail laboratory study will be given in a later report.

The treatment consisted of: intravenous serum (polyvalent antigas gangrene serum) therapy, normal saline, 20 per cent glucose and buffer solution intravenous infusion. A detail report of this therapy will be given at a later date.

The clinical course in this patient gradually changed from a semicomatose uremic state to a normal, bright active state so that the patient appears clinically well.

The prognosis of puerperal sepsis, *Bacillus Welchii* is dependent on the extent of and duration of the infection, the associated bacteria, the early treatment with specific serum and the degree of kidney damage. From the literature it is quite evident that only that type in which the uterine musculature was invaded was serious and proved fatal frequently. One-third of the patients died within forty-eight hours after the infection had taken place and over one-half within four days. My first patient, V. W., was the only patient to have lived so long after the infection. Of course, she recovered from the infection but died from the inability to cope with the conditions present with her damaged kidneys. The outcome was usually fatal when other organisms, especially the hemolytic streptococcus, was also present. In my second patient, T. H., there was an associated peritonitis due to the other organisms. According to Brütt and Lehmann, the mortality might be reduced by early recognition of the disease and extirpation of the uterus. The additional use of the specific serum might be of further value.

The treatment of this type of puerperal sepsis should have for its aims the early administration of specific serum and blood transfusion, to overcome the marked toxemia, and to prevent the extreme blood changes and renal damage; the gentle encouragement and stimulation of renal function by inducing diuresis with normal saline and concentrated glucose infusions. Such radical procedures as hysterectomy which has been used by some with apparent success should only be considered when the patient's condition may allow it and when necessary. Although it would be difficult to set forth rules for hysterectomy, it might be indicated when the appearance of the patient and the findings did not change in spite of liberal administration of the antigas bacillus serum and blood transfusion indicating a source of great toxin producer (infected uterus) and also in the absence of a streptococcal peritonitis. Lehmann used as an indication for hysterectomy, crepitation of the uterus on palpation. Other recent reports (after 1928) of gas bacillus infections are those of Kohl, Baize and Mayer, Ivens and Offergeld.

#### COMMENTS

The mechanism of infection with the *Bacillus Welchii* has been studied in animals by DeKruif and Bollman. The primary conditions for infection are established by the various factors described by Wrigley. "The spores introduced at this time are able to germinate, and having passed into the vegetative stage, find in the injured muscular tissue, an admirable medium for the production of the specific toxic substance. This substance, with its diffusibility aided by the outpouring of edema fluid that invariably accompanies infection, is able rapidly to necrose further tissue and so furnish new medium for the growth of the organisms. Finally an area of necrotic tissue sufficient to furnish medium for the growth of an enormous number of organisms is produced. These then are able to produce enough toxin to bring about toxemic death." (DeKruif, et al.). These investigators do not enter into the discussion of the cause of death although the patient has recovered from the toxemia and infection. The same method of extension of the infection occurs in the human body as observed in autopsy studies. There is the additional factor of associated bacteria that comes into play in human infections.

DeKruif, Adams and Ireland have demonstrated also, that different strains of *Bacillus Welchii* produce toxins of varying degrees of potency. However, they also showed that an antitoxin produced by one strain, was capable of neutralizing the toxins of other strains. This fact is of value therapeutically, because a stock antitoxin may be used in the presence of an infection of any strain of *Bacillus Welchii*. Ivens reported a favorable report with the serum.

Although the jaundice and even bronzing of the skin does not occur in surgical *Bacillus Welchii* infections as frequently as in uterine infec-

tions, it does occur. Bingold reported a case presenting the bronze skin, oxyhemoglobinemia and methemoglobinuria, etc., after an infection of the thigh by a hypodermic needle.

The marked renal changes and the anuria must be elucidated since, with the exception of Lehmann and Fraenkel's paper, no previous publication made mention of them. My experience has been especially unique in that an early and late kidney was observed and one apparently recovering with similar clinical pictures. In the early case (seventy-two hours after induction of infection) the typical picture of an acute necrosis of the proximal convoluted tubules associated with obstruction of the tubules with broken-down hemoglobin and cell debris may well explain the anuria. These changes were due to the severe toxemia produced by the *Bacillus Welchii* toxin and were the same as in all the tissues, especially the liver and heart where the organisms also flourished. In the kidney of the late case (one month after the onset of infection), the tubules had apparently regenerated anatomically but not sufficiently physiologically low syncytial character of epithelium of convoluted tubules and, therefore, uremia was the cause of death.

In the patient who has recovered from the infection and is apparently recovering from the effects of the toxemia, presents some very interesting clinical evidence of renal damage and recovery. The effect of the glucose and buffer solution to produce diuresis is quite evident. The importance of this diuresis is appreciated when one compares it with the diuretic influence of intravenous fluid therapy in the kidney of mercury bichloride poisoning. Hayman and Priestly report a case of mercuric chloride poisoning whose anuria was not effected by decapsulation of the kidneys. Normal saline infusions given intravenously induced an increased urinary output and a drop in blood urea nitrogen from 247 mg. per 100 c.c. to 85 mg. per 100 c.c. in three weeks. The remarkable observation was that there was no detectable phenolsulphonaphthalein excretion in two hours at the end of six weeks of treatment when the patient left the hospital against advice. Yet five months later no evidence of impaired renal function could be detected. The chief renal lesion in bichloride poisoning consists in necrosis of the cells of the convoluted tubules. This results in marked impairment of the concentrating power of the kidney and consequent loss of its ability to eliminate waste products in a small volume of urine. A similar renal picture is seen in *Bacillus Welchii* toxemia. Shapiro in his description of the renal pathology of mercury poisoning states that the tubules regenerate in seven days with extraordinary activity and rapidity. It is, therefore, apparent that the clinical problem as far as the nephrosis is concerned, is to prevent death from acute retention of waste products until time has elapsed for regeneration. Although in the second case the woman lived a month after the onset of the infection, she vomited daily and did not receive sufficient fluids. Perhaps these factors and the pyelitis found on microscopic examination prevented a full recovery of the kidneys.

## CONCLUSIONS

1. The early diagnosis of *Bacillus Welchii* puerperal sepsis is essential in order to derive any effect from the polyvalent antitoxin which is on the market. It is usually based on the history of pathologic pregnancy, labor, puerperium, or abortion. The characteristic observations are acyanotic icteric or bronze skin, hemoglobinuria, hemoglobinemia, anuria and *Bacillus Welchii* in cervical smear and culture.

2. In addition to treating the toxemia, large amounts of hypertonic glucose (for caloric and diuretic effect), buffer solution and normal saline should be given intravenously.

3. Decapsulation of the kidneys does not seem to be a logical operation in view of the pathology.

4. The prognosis depends on the establishment of diuresis and thereby the elimination of the nitrogen waste products until the necrotic convoluted tubules have regenerated.

5. The importance of cervical smears and cultures is again demonstrated in the diagnosis and treatment of puerperal fever.

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30 NORTH MICHIGAN AVENUE.

## ABSTRACT OF DISCUSSION

DR. A. F. LASH (closing).—I cannot give any detailed history as to the origin of the serum. The Pasteur Institute was mainly instrumental in producing it, following the World War. The bacteria producing gangrenous lesions are combined to make a polyvalent commercial stock product instead of having an individual product for each strain. This is possible because the antitoxin for one strain will neutralize the toxin of related strains as demonstrated by DeKruif and his workers. It seems that if one of these organisms enters the uterus and remains there long enough under favorable conditions it will grow and produce necrosis and this will enhance further growth of the organisms in the dead tissue and also toxin production.

Another important question is the terminology of puerperal sepsis. As you notice, my title is, "Puerperal Sepsis: *B. Welchii*, Fatal Types." I think a better picture of puerperal infections is given when a clinical, pathologic and bacteriologic term is used which would rule out a lot of the so-called puerperal infections. Some of the cases Dr. Falls described may be considered merely infections of the fetuses.

A clear mental picture is given when one specifies as follows, the type of infection, puerperal sepsis, acute metritis and toxemia, B. Welchii.

In none of these cases I observed did I notice gas issuing from the vagina or cervix. In two, the vaginal discharges were foul.

The points I tried to bring out are: First, these cases are mistaken because there is no gas to give the clinician the impression that he has a gas infection. Therefore, it is important to remember, the bronzing of the skin, hemoglobinuria and hemoglobinemia, and examining a stained smear from the cervix in order to establish the diagnosis immediately. The next important thing is the use of the specific serum which must be repeated as long as there is evidence of infection. The next thing is dealing with the kidney lesions, by inducing a marked diuresis to remove from the circulation the marked amount of nitrogenous end products produced by toxic changes occurring in the liver and other parenchymatous organs. These cannot be thrown out in a small amount of urine. This can be produced by pushing fluids in the form of intravenous saline, buffer and hypertonic glucose solutions.

DR. FALLS (closing).—Replying to Dr. Bacon as to the percentage of cases in which the organisms are found in the vagina of normal women, it occurred to me that these must be frequently present in women who are otherwise normal. If we are to get patients showing the gas bacillus in a case like the fourth one I reported, who was in the hospital for twenty-eight days suffering from decompensated heart, and who suddenly aborted without any vaginal manipulation, we think that the gas bacillus must have been present before the abortion started.

The only series of cases of normal women who did not show gas bacillus was at St. Vincent's Hospital. These patients come in at about the eighth month of pregnancy. The highest percentage was in the abortions and that carries the same significance as other workers have pointed out. We had 29 per cent, that is one in about three abortions, at the Cook County Hospital. In the prenatal clinic at the County Hospital, which is composed of a large percentage of colored patients, we found 7.69 per cent, while in the prenatal clinic at the Research Hospital, with the same type of individual but a little higher grade and more whites, we found only 4.85 per cent. In the gynecologic department, where the patients are having treatment and where they are living at home and have a normal sexual relationship, we find 33 per cent. Apparently the percentage depends upon the type of patient. If we were to take cultures from the private patients we would probably rarely run into a gas bacillus.

The odor of the bacillus has been referred to frequently. I believe that the odor and gas production depend on the infection in a late stage of the pregnancy. When the fetus is large enough so that gas cannot get out, then the gas will be retained in the uterus and will produce physometra. The odor may depend also on an associated anaerobic gas producing streptococcus, and we may have a different odor due to two forms of gas being present at the same time.

As to the virulence of this strain, it has been found that growing gas bacillus with other organisms changes its virulence and, if it is found with streptococcus, it may not be the streptococcus that causes all the damage, but the presence of streptococcus produces an anaerobic condition for the gas bacillus to grow and enhances the production of gas. It is quite evident in these cases that most of them are mixed infections. Because the gas bacillus is easy to cultivate, it is apt to overgrow. The streptococcus may be very difficult to cultivate and gas bacilli may overgrow the anaerobic streptococcus and be given the credit for producing death. It is quite significant to my mind that the gas bacillus has not fulfilled the laws of Koch with respect to this disease, and that no one has described an epidemic of this infection.



## ENTEROUTERINE FISTULA\*

WITH A REVIEW OF THE LITERATURE AND REPORT OF A CASE STUDIED  
RADIOLOGICALLY

W. C. DANFORTH, B.S., M.D., F.A.C.S., AND JAMES T. CASE, M.D.,  
D.M.R.E. (CAMP.), F.A.C.S., EVANSTON, ILL.

(From the Departments of Obstetrics and Gynecology and of Radiology of Northwestern University and of the Evanston Hospital)

A SURVEY of the literature indicates that enterouterine fistulas are not common. We have found reports of 58 cases during the past two hundred years in which a fistulous communication existed between the bowel and the uterus. Le Jemtel reported a case seen by him in 1907 and collected 21 others previously reported. He divides the enterouterine fistulas etiologically into three classes:

1. Ruptures of the uterus, either spontaneous or produced during labor.
2. Peritonitis (a) pathologic puerperium, (b) appendicular.
3. Cancer.

The explanation of Le Jemtel as to the mechanism of the production of the fistulas seems quite sufficient.

1. "By strangulation. Most frequent in uterine rupture. The intestine enters a more or less large tear, the uterine contractions strangulate it and the changes which follow are those which are found in a strangulated hernia. Gangrene, establishment of protective adhesions, and escape of intestinal contents by the genital canal.

2. "By the simultaneous or consecutive opening of an abscess in the intestinal and uterine cavities. Whether it be a peritonitis following puerperal infection or an infection following appendicitis, the phenomena are identical. The abscess opens but the inflammatory changes have already united the uterus and the intestine, their walls are thinned, without resistance and the communication is easily explained.

3. "In cancer of the uterus the lesion is about the same, cancerous projections springing from the uterus, in incessant contact with the bowel coils, at the level of the pouch of Douglas, produces an irritation which, little by little produces adhesion. The cancerous growth infiltrates the intestinal wall, ulceration and loss of substance occurs between the intestine and uterus and fecal matter escapes by the genital canal."

The fistulas of carcinomatous origin are apparently far rarer than those following trauma. The literature of recent years shows a lessening frequency of severe obstetric injury followed by enterouterine fistula. We have been able to find 37 cases following injury, 14 cases as a result of inflammatory processes or congenital lesions, and seven cases of a carcinomatous fistula. Our case makes a total of eight reported enterouterine fistulas of carcinomatous origin.

*The Location of the Fistula.*—In Le Jemtel's collected series there was one case each of a communication between the sigmoid and the uterus

\*Read at a meeting of the Chicago Gynecological Society, April 15, 1932.

and between the cecum and the uterus. He reports three others in which the exact location of the fistula in the bowel was not known. In all the other cases in his series the seat of the opening in the bowel was in the small intestine. The seat of the opening in the uterus, if the fistula follows an inflammation, is usually in the fundus. A traumatic fistula is located at the point of injury to the uterine wall. As Le Jemtel points out, the size of the fistulous opening varies. A laceration produced by the forceps in which intestine becomes strangulated is much larger than the opening produced by the opening of an abscess, which has formed between two structures, which are firmly adherent.

Neugebauer of Warsaw, in 1902 collected 31 cases of enterouterine fistula. A number of Neugebauer's cases are also reported by Le Jemtel. In 2 of the cases collected by him the fistula was found between the stomach and the uterus, in 9 cases uterorectal, in 3 cases between the uterus and the sigmoid, and in one case between the uterus and the transverse colon. In 12 cases the small intestine communicated with the uterine cavity. In one case an opening into the uterus was found from both the small bowel and the sigmoid.

The treatment of fistulas of this variety is dependent wholly upon the cause. In those resulting from invasion of the bowel wall, by carcinoma originating in the fundus of the uterus, there is ordinarily little hope of surgical relief. In the case here reported the carcinomatous involvement was already so extensive that no possibility existed of excision of the involved structures. When a fistula between the bowel and the uterus is found which is a result of trauma, laparotomy may be done with the hope of freeing the bowel from the uterus and closing the openings in the bowel and uterine fundus. A resection of the intestinal loop may be needed. This was done in several of the cases collected by Neugebauer with success in some of them. In one case, among those collected by Neugebauer, the fecal discharge was caused to stop by surgically closing the external os of the uterus.

#### CASE REPORT

Mrs. R., aged fifty-eight, entered hospital, October 28, 1931. Married twenty-five years. No children. Menopause occurred normally at forty-five. No serious illnesses until onset of present trouble. At ten years of age she states that she had abscess in rectum which evacuated itself spontaneously. About two years ago had considerable backache. She has been treated by medical men at times in past two or three years for colitis.

About two weeks ago a discharge began through the vagina of material which evidently came from the bowel, food remnants were seen and the discharge was not voluntarily controllable. This has continued daily until the time of admission. Examination after admission revealed a well nourished woman. Blood pressure 100/60. Heart and lungs normal. Physical examination essentially normal.

The vagina was normal. During the examination a sudden flow of material, obviously of intestinal origin, containing food remnants, and fluid in character, occurred. The cervix was small, pointed backward, mobility somewhat diminished. The fundus was irregular in shape, a mass palpable posteriorly and a little to the left, mobility diminished. The adnexa were negative.

As no rectovaginal fistula was found to account for the presence of the intestinal

contents in the vagina, a speculum was introduced which definitely showed that the fluid noted above came from the cervix. A uterine sound passed from the cervix, passed up through the uterus and apparently to a point beyond where the fundus of the uterus should be. Its withdrawal was followed by a small amount of bright red fluid blood.

*Proctoscopic Examination.*—(By Dr. Charles E. Pope.) The distance observed, 14 to 15 cm. There is an anterior sigmoid fixation and a sense of a tumor mass. No sigmoid or rectal blood. Sigmoid shows marked obstruction from angulation at the point of apparent adhesions to the uterus and about 14 cm. from the rectal opening.

*Radiologic Examination.*—(By Dr. James T. Case.) The patient was placed in the dorsal position, a vaginal retractor inserted, and the vagina cleansed of fecal matter. An attempt was made to sterilize the vaginal tract with mereurochrome.



Fig. 1.—Uterine cavity after injection of 8 c.c. of iodized oil. Note the filling defect on the right side of the fundus, with irregular contours indicating a tumor of the fundus intruding itself on the uterine cavity. None of the opaque material had passed into the tubes or through the fistula.

The cervix was conical, and apparently normal. A cannula was introduced into the cervix for a distance of five centimeters. Everything being in readiness and the appropriate instruments at hand, 15 c.c. of opaque oil was introduced into the uterine cavity with moderate pressure, and control films exposed. These films showed a deformed uterine cavity (Fig. 1), there being a defect of filling in the right anterior portion of the fundus in the neighborhood of the right cornu, involving most of the right side of the fundus, and being very suggestive of a neoplasm. These films showed that as yet no opaque material had passed through the tubes. We accordingly prepared the patient a second time, and injected more opaque oil, after which further roentgenograms demonstrated that the oil had passed into the cecum (Fig. 2), apparently by way of the terminal ileum, although the entire pathway was not demonstrable. We assumed that the communication had been with the terminal ileum not far from the cecum, because the passage from the uterus to the cecum and ascending colon had occurred with such rapidity. The appendix at this time was not visualized, and anyhow the distance between the uterine fundus and

the rather high cecum was too great for the communication to have occurred by way of the appendix. We accordingly concluded that the lesion in the uterus was a carcinoma, and that there had occurred a spontaneous communication with the terminal ileum near the ileocecal junction. Another roentgenogram twenty-four hours later showed the opaque oil practically all in the colon, filling it from the cecum to the splenic flexure inclusive (Fig. 3). The appendix was visualized at the time, and further confirmed the conclusion that the fistula had not involved it. A few drops of the opaque oil were now noted in the true pelvis, indicating that the left tube was patent.

In view of the septic nature of the contents of the uterus, we felt some anxiety about the passage of some of the potentially infected oil into the peritoneal cavity, for it is well known that even the high content of iodine in the opaque oil does not render it antiseptic; but we reflected that this patient had already withstood the



Fig. 2.—The same after further injection of opaque oil. Note the ragged contours of the filling defect in the right side of the fundus uteri, still further confirmatory of the malignant nature of the tumor; some opaque oil above the fundus, having passed through the left tube; and a considerable quantity of opaque oil in the region of the cecum, with a considerable gap between it and the uterine fundus, leading to the assumption that the connection was by way of small intestine rather than the appendix.

presence of a fecal fistula for some time, and was probably well protected against *B. coli* infection.

*Operation.*—November 4, 1931. On opening the abdomen, the terminal coil of ileum was found attached to the fundus of the uterus at a point about eight inches from the cecum. The entire fundus was greatly enlarged, hard, indurated, and nodular, and this indurated feeling extended over into the wall of the ileum. On the left side of the fundus of the uterus, just below the point of attachment of the ileum the sigmoid was also firmly attached, and this apparently also was invaded with the same growth. This growth extended out backward and laterally into the parametria on both sides. There were apparently enlarged retroperitoneal lumbar glands. The entire mass was of slight mobility, and unquestionably was a malignant affair, probably primary in the uterus.

Median incision was made, sufficient in length to allow of easy exploration. As

the operation was so extensive as to be accompanied by grave danger, and because even an extensive operation would still leave retroperitoneal carcinomatous involvement and probably carcinoma in the parametria, it was decided to do nothing, but to close the abdomen without any operative attempt being made. The usual closure was done with stay sutures of braided silk, layer sutures in the abdominal wall and running silk in the skin. No laparotomy pads were introduced. No drainage. No anesthetic complications.

The case which we present is of interest in that it is the first one in which radiologic study has demonstrated the site of the fistulous opening in the bowel. It is true that in most cases the location may be determined



Fig. 3.—Film showing disposition of the opaque oil twenty-four hours later. There is now no doubt about the identity of the visualized loops of colon. Appendix visualized, evidently not involved in the fistulous passage.

with approximate accuracy by the character of the discharge and possibly by the presence of excoriation upon the vulva. It is also a fact that in cases of carcinomatous fistula the fistulous opening is merely an event in the later history of a case of carcinoma of the uterus, and that attempts at surgical relief are likely to be useless. It has been of interest, however, to demonstrate that localization of such a lesion radiologically is possible, especially as it had not been done before. Hystero-graphy as a routine procedure in carcinoma of the uterus would not be a desirable procedure. The possibility of forcing particles of carcinomatous tissue through the tubes into the peritoneal cavity is to be feared, and Sampson has drawn attention to the possibility of migration of malignant cells from the uterine cavity into the abdomen. Inasmuch

as in cases in which a carcinomatous fistula already exists, as much secondary invasion has already occurred as is possible, and as the presence of the fistula itself, allowing the passage of the lipiodal from the uterine cavity into the bowel, reduces the danger of the fluid being driven through the tubes, it seems a safe procedure.

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636 CHURCH STREET.

\*Some of the references which follow are copied from Le Jemtel, and have not been verified, because of inaccessibility of the volumes referred to.

# REPORT OF A CASE OF CONGENITAL DEFECT IN THE DIAPHRAGM\*

CHARLES NEWBERGER, S.B., M.D., CHICAGO, ILL.

(From the Department of Obstetrics, Mount Sinai Hospital)

MRS. J. G., thirty-two years of age, married eight years, presented herself in the Prenatal Clinic on September 16, 1931, in the sixteenth week of her first pregnancy.

Her father died in 1917, at the age of sixty, in the war zone; her mother, six sisters, and three brothers are living.

She had had measles, diphtheria, scarlet fever, whooping cough, and an operation for hemorrhoids. In January, 1927, she was seen in our out-patient medical

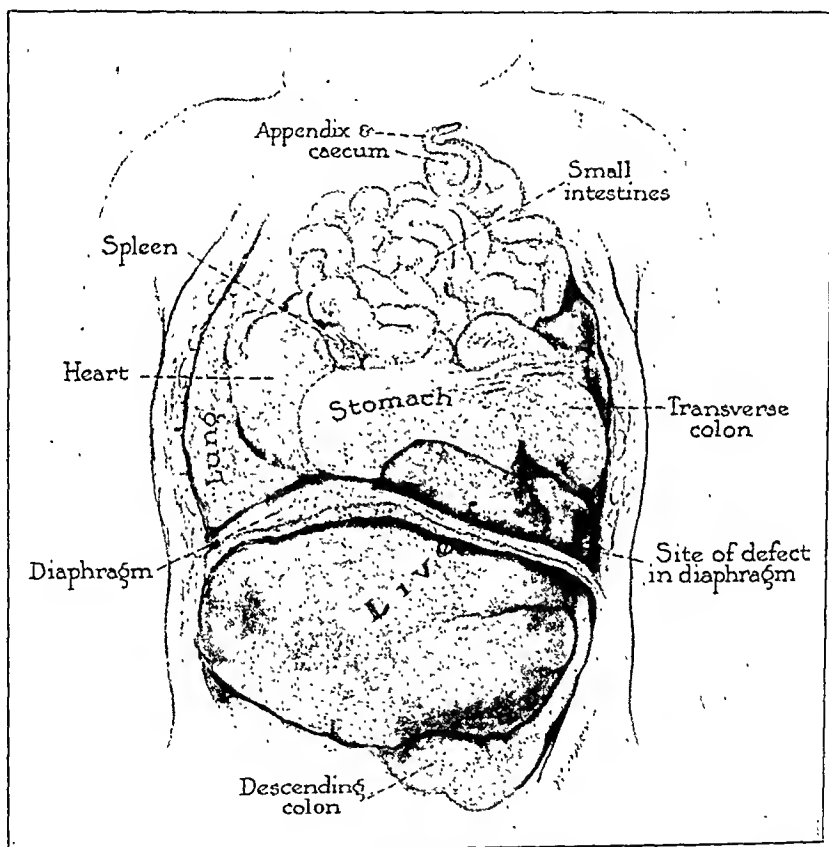


Fig. 1.—Showing arrangement of viscera on opening chest and abdominal cavities.

clinic for anorexia, loss of weight, weakness, and cough; she was poorly nourished, weighed 80 pounds, and had suspicious findings in the apex of the right lung, posteriorly. She was placed under observation and treatment, and gradually gained slightly in strength, and about fifteen pounds in weight.

Her menses began at seventeen years of age, were irregular in type, twenty-nine to thirty-five days apart, of two or three days' duration, scanty in amount, and painful.

\*Presented before the Chicago Gynecological Society, April 15, 1932.

She was married in 1924, and in August, 1929, consulted our gynecologic department for her sterility.

Her last menstrual period was May 27, 1931, and she was scheduled to deliver March 2, 1932. On her first visit, she complained of occasional headache, dizziness, nausea, vomiting, edema, and numbness of her hands. She weighed 98 pounds, and appeared rather poorly nourished. Her pelvic measurements were: interspinous, 25 cm.; intercrystal, 28 cm.; intertrochanteric, 30 cm.; external conjugate, 18 cm. Vaginally, there was evidence of general contraction of a moderate degree, with a diagonal conjugate of 11 cm. Wassermann was negative; sputum was negative; red blood cell count was 4,800,000; hemoglobin was 75 per cent. She was seen regularly during the prenatal period, the blood pressure averaging 120/60, the urine showing a trace of albumin on two examinations. At eighteen weeks, she was treated for chronic otitis media, and at thirty-two weeks for a mild grippal

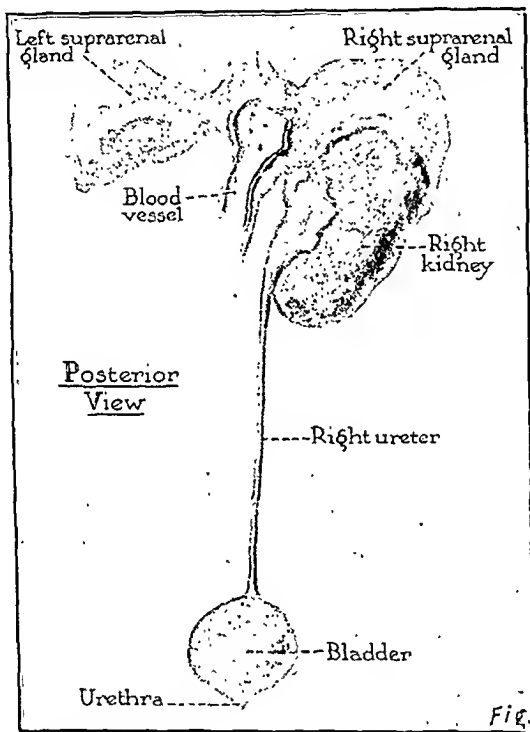


Fig. 2.—Showing absence of kidney and ureter on left side.

infection. On February 24, a week before term, she weighed 122 pounds, having gained 24 pounds in twenty-three weeks. On March 7, 1932, being then five days overdue, she was admitted to the hospital for observation. The fundus was found eight fingerbreadths above the umbilicus, the fetus was in O. L. T. position, head floating, fetal heart rate 140, blood pressure 88/40, and a trace of albumin was found in the urine. X-ray showed a baby of normal contour.

Pains set in March 9, at 5 A.M., and soon were strong and five to six minutes apart. Rectal examination at 5:45 A.M., revealed only 1 cm. dilatation, with the head floating; at 10:15 A.M., dilatation was 3 cm., station of the head still high; at 1:15 P.M., the findings were the same. Because of the generally contracted pelvis, the signs of disproportion, the failure of engagement of the head after eight hours of good pains, the past medical history, and the seven years of sterility, with the x-ray showing a normal baby, and the fetal heart rate 140 and of good quality,



low cervical cesarean section was done. A male baby was delivered without difficulty. It gave a few inaudible gasps, and, in spite of the usual treatment for asphyxia, which was kept up for more than an hour, and included the tracheal catheter, artificial respiration, hot bath, adrenalin, lobelin into the cord, and oxygen, it could not be resuscitated. While attempting rhythmic compression of the heart and lungs, it was noted that the heart beat, which continued for about thirty minutes after birth, was present on the right side of the chest, suggesting the possibility of either diaphragmatic hernia, or situs inversus viscerum.

Autopsy was performed three hours after birth, by Dr. I. Davidsohn, who reported as follows:

*Macroscopic.*—A white male newborn, 48 cm. long, and weighing 3365 gm. The head was perfectly round; there was no evidence of moulding or compression. The hair was well developed. The pupils were equal and measured 3 mm. in diameter.

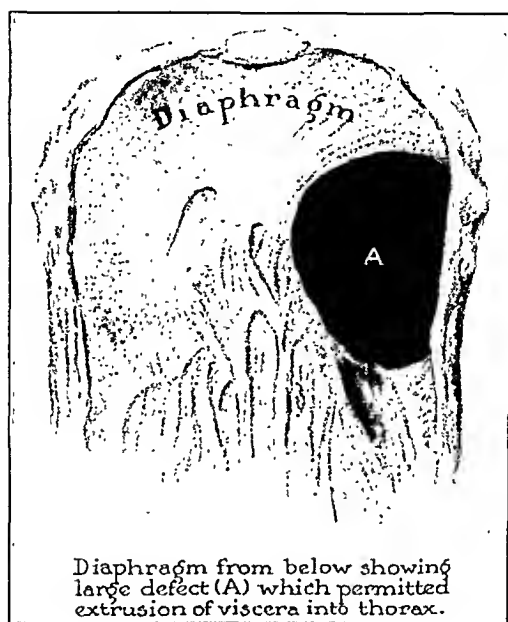


Fig. 3

The lips were markedly cyanotic. The ears, nose, mouth, and neck, showed no abnormalities. No rigidity was present; slight lividities presented posteriorly. The umbilical stump measured 4 cm. There was no evidence of hemorrhage, or of adenopathies. Both testicles were in the scrotum.

*Abdominal cavity.*—The liver filled out at least four-fifths of the peritoneal cavity. There was no free fluid. The right diaphragm was pushed downward; the left diaphragm was preserved only in its anterior and lateral portions, measuring about 2 cm. in the widest diameter, and surrounding a large defect through which one-half of the left lobe of the liver, the spleen, the stomach, the pancreas, the entire small intestine, and the major portion of the large intestine had entered the chest cavity pushing the heart and left lung into the right half of the chest cavity. The resulting position was such that the right lung was compressed and covered by the heart, which was lying on the diaphragm. Next to the heart and on its left side was visible a portion of the spleen covering up the left lung. Then came the large intestine, the appendix being visible in its entire length in the upper part of the neck.

*Thymus.*—Weighed 15 gm. and appeared somewhat enlarged; its consistency and

appearance were normal. *Heart*: the muscle and valves showed no abnormalities. *Lungs*: right, was atelectatic; otherwise it appeared normal; left, was distinctly hypoplastic, being about the size of the middle lobe of the right lung. *Spleen*: appeared large, measuring 4 by  $3\frac{1}{2}$  by  $1\frac{1}{2}$  cm. *Liver*: measured  $12\frac{1}{2}$  by  $8\frac{1}{2}$  by  $4\frac{1}{2}$  cm. It appeared very much enlarged; its consistency was soft, its cut surface was normal. *Pancreas, stomach, small intestine, and adrenals*: showed no abnormalities. *Mesenteric lymph nodes*: were prominent, but not enlarged. *Large intestine*: was filled with meconium. *Right kidney*: measured  $4\frac{1}{2}$  by 3 by  $1\frac{1}{2}$  cm. Appeared somewhat enlarged; its cut surface, and the right ureter were normal. *Left kidney and left ureter*: both were absent. *Urinary bladder*: contained only one, the right, ureteral orifice; otherwise normal. *Brain*: the external appearance, as well as the cut surface of the formalin-fixed brain presented no abnormalities.

(Note: The organs were left together and therefore not weighed.)

*Microscopic*.—Sections of the liver, thymus, and spleen showed no abnormalities.

*Gross Anatomical Diagnosis*.—There was a congenital defect on the left side of the diaphragm, with ectopia of the stomach, pancreas, small and major part of the large intestine, spleen, and portion of liver into the chest cavity, with displacement of heart and left lung into the right half of the chest. Hypoplasia of the left lung. Aplasia of the left kidney, and of the left ureter.

Comment: The x-ray plates were reexamined, but they were found to be of no value in suggesting the presence of the abnormalities. This case also illustrates the simultaneous occurrence of more than one fetal anomaly, and, further, it emphasizes the need for insistence of autopsy in cases of stillbirths. If this baby had been delivered vaginally, and no autopsy performed, its death would have been charged to the obstetric judgment which attempted such a delivery under the existing conditions.

310 SOUTH MICHIGAN AVENUE.

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## A CASE OF LEUCOPLAKIA OF THE VULVA FOLLOWED BY CARCINOMA DEVELOPING IN THE SCAR OF THE VULVECTOMY\*

DR. E. W. FISCHMANN, CHICAGO, ILL.

At the last meeting Dr. Culbertson presented a case of leucoplakia of the vulva that showed carcinoma in the same section. I would like to report a case of leucoplakia of the vulva which was followed two years later by carcinoma developing in the scar following vulvectomy for the leucoplakia. This patient presented herself in January, 1930, because of intense itching of the vulva of one year's duration. She was then sixty-eight years of age. At that time the vulva showed considerable loss of pubic hair, a great many scratch marks, a number of bluish-white plaques, and a parchment consistency of the skin with marked atrophy of the labia minora and labia majora and gapping of the external urinary meatus. Because the patient preferred surgical treatment, vulvectomy was done. She was relieved of the itching and was fairly comfortable until January, 1932, when she presented herself again because of bleeding from a small growth about 3 mm. in diameter and about 6 mm. above the level of the skin. This tumor was rather friable, but she had no inguinal adenopathy. At this time we resected the tumor and some of the surrounding area and did a plastic; the inguinal glands were also removed by Bassett's operation.

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\*Described at a meeting of the Chicago Gynecological Society, April 15, 1932.

# Society Transactions

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## AMERICAN ASSOCIATION OF OBSTETRICIANS, GYNECOLOGISTS AND ABDOMINAL SURGEONS

### FORTY-FIFTH ANNUAL MEETING

*French Lick Springs, Ind., September 12, 13, and 14, 1932.*

The following papers were presented:

**New Methods of Study Applied to Maternal Mortalities in the Hospital.** DR. A. J. SKEEL, Cleveland, O. (See page 187.)

**Report of a Case of Myoma of the Anterior Wall of the Vagina.** DR. F. REDER, St. Louis, Mo. (Published in the current volume of the Society's Transactions.)

**A Study in Correlation of the Sedimentation Test, Filament-nonfilament, and the White Cell Count in Gynecology.** DRs. H. W. YATES, D. M. DAVIDOW, E. PUTMAN, AND F. ELLMAN, Detroit, Mich. (See page 203.)

**Placenta Accreta.** DR. E. L. DORSETT, St. Louis, Mo. (See page 274.)

**Some Observations on Effects of Sympathetic Ganglionectomy of Certain Intestinal Conditions.** DR. F. S. WETHERELL, Syracuse, N. Y. (Published in the current volume of the Association's Transactions.)

**The Legal Responsibility of the Gynecologist.** DR. E. J. ILL, Newark, N. J. (Published in the current volume of the Association's Transactions.)

**Some Phases of the Toxemias of Pregnancy.** DR. B. SOLOMONS, Dublin, Ireland. (See page 172.)

**The Relationship Between Exogenous Throat Streptococci and Puerperal Infections.** DRs. F. KELLOGG, AND A. T. HERTIG, Boston, Mass. (See page 213.)

**Injury to Ureters, Including Accidental Ligation During Pelvic Operations.** DR. Q. U. NEWELL, St. Louis, Mo. (See page 220.)

**Prevention and Control of Morbidity and Mortality From Puerperal Infection by State or Municipal Supervision and Inspection.** DR. C. S. BACON, Chicago, Ill. (See page 194.)

**A Report of the End Results of Five Hundred Fifty-Four Consecutive Hysterectomies.** DR. L. E. PHANEUF AND DR. M. O. BELSON, Boston, Mass. (See page 262.)

**The Qualifications of the Specialist.** DR. W. T. DANNREUTHER, New York, N. Y. (See page 165.)

**Uterine Cancer and Its Treatment by Radium.** DR. A. P. LEIGHTON, Portland, Me. (Published in the current volume of the Association's Transactions.)

**Foreign Bodies Left in the Abdomen After Operations.** DR. J. P. GREENHILL, Chicago, Ill. (See page 231.)

**Sigmoidouterine and Vesicouterine Fistula as a Complication of Childbirth.** DR. W. C. G. KIRCHNER, St. Louis, Mo. (See page 241.)

**Multiple Dermoids of the Ovary.** DR. J. R. MILLER, Hartford, Conn. (See page 252.)

**Prolapse of the Uterus.** DRs. W. A. COVENTRY, AND R. J. MOE, Duluth, Minn. (See page 257.)

## CHICAGO GYNECOLOGICAL SOCIETY

*STATED MEETING APRIL 15, 1932*

Report of a Case of Congenital Defect in the Diaphragm. DR. CHARLES NEWBERGER. (See page 306.)

A Case of Leucoplakia of the Vulva Followed by Carcinoma Developing in the Scar of the Vulvectomy. DR. E. W. FISCHMANN. (See page 309.)

Enterouterine Fistula, With a Review of the Literature and Report of a Case Studied Radiologically. DR. W. C. DANFORTH AND DR. J. T. CASE. (See page 300.)

Endometritis and Physometra Due to the Welch Bacillus. DR. F. H. FALLS. (See page 280.)

Puerperal Sepsis: B. Welchii, Fatal Types. DR. A. F. LASH. (See page 288.)

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Dr. William P. Graves, of Boston, Emeritus Professor of Gynecology, Harvard Medical School, and a member of the Advisory Editorial Board of the JOURNAL, died on January 25, 1933, at the age of sixty-three.

A more extended obituary notice will be published in the March issue.

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# Department of Reviews and Abstracts

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CONDUCTED BY HUGO EHRENFEST, M.D., ASSOCIATE EDITOR

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## Selected Abstracts

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### Sterility and Sterilization

Moench, G. L.: *Methods of Examining Sterile Couples*, *Monatsschr. f. Geburtsh. u. Gynäk.* 90: 150, 1932.

The investigation of sterile couples must be carried out with great care. The entire life history of both husband and wife from the time of birth on must be studied carefully. This study should include the mode of life, the diet, the frequency of coitus, etc. The man is more often responsible for sterility than is usually realized. The presence of motile spermatozoa is no indication that a man is normally potent. Moench thoroughly studied the morphologic and biometric characteristics of sperm and he found that a normal man does not have more than 19 to 20 per cent of abnormal sperm heads and that the coefficient of variability as determined by the curve of the lengths of the sperm heads does not exceed 11 to 11.5 per cent. In no case of sterility should it be taken for granted that the male is capable of fertilization. Before any manipulation such as a tubal patency test, dilatation of the cervix, curettement, operation for retroflexion, etc., is practiced on the woman, the man should be examined even though he may have procreated children with another woman or even with the same one.

J. P. GREENHILL.

Rubin, I. C.: *The Rôle of Appendicitis in the Etiology of Female Sterility*, *Monatsschr. f. Geburtsh. u. Gynäk.* 92: 161, 1932.

In Rubin's series of 3,143 cases of sterility there was a history of appendectomy in 465 cases or 14.7 per cent. Almost 75 per cent of the latter patients had been sterile for more than three years. Anticonceptional methods were used by only 10.3 per cent of all these patients hence this factor plays a very small rôle in sterility.

Among the 465 cases, there were 130 cases or 28 per cent of relative sterility. Pregnancies occurred in 48 before and in 82 after the appendectomy and almost half of the women who conceived after the operation aborted.

In 55.9 per cent of the cases the appendix was removed before and in 43.1 per cent after marriage. Hence in more than half the cases the male partner can be eliminated as the etiologic factor.

In six cases the patients had been operated upon before the appendectomy and in 40 additional cases an operation was performed after the appendix was removed. In 20 of the 40 operations done after the appendectomy the tubes or ovaries or both were operated upon.

Huhner tests performed in 300 cases showed that the spermatozoa were normal in only 62 per cent. In 81 of the 465 cases the female genitalia showed signs of hypoplasia. There were 42 cases of retroflexion and retroversion, and enlarged, thickened or cystic adnexa in 86 additional cases.

The author found that appendicitis has a deleterious influence on the ovaries, for disturbed ovarian function as measured by disturbances in menstruation occurred in 32.3 per cent of the interval and in 16.67 per cent of the acute cases of appendicitis.

In most instances the disturbance was in the form of an oligomenorrhea or a hypomenorrhea.

In 306 cases the tubes were insufflated and found patent in only 39.5 per cent. Pregnancy occurred in 35 of the 306 cases or 11.4 per cent as compared with 16 per cent for the general group of 2113 patients who had Rubin tests. In almost half of these cases, conception took place within two months after the insufflation. The author concludes that even the mildest attack of appendicitis in a young woman or in a woman in the childbearing period should not be considered lightly but an appendectomy should be performed as early as possible.

J. P. GREENHILL.

**Moench, G. L., and Holt, Helen: Biometrical Studies of Head Lengths of Human Spermatozoa, J. Lab. & Clin. Med. 17: 297, 1932.**

Moench and Holt have made a special study of the biometrics of human sperm heads with reference to diminished fertility. Of 141 different cases studied, 124 were calibrated. They summarize their work on impaired human fertility as follows: Sterility and fertility are not separate entities, the latter being of various degrees and starting from a normal, proceeds gradually downward to such low values that clinical sterility results. Absolute sterility is much less frequent than commonly supposed, being due to gross lesions which in most instances can be determined. In the exact determination of the fertility of any given individual, all the factors in the history are almost as important as the physical examination.

By means of careful semen examinations it is possible to determine the degree of fertility of any given man. Such examination should include sperm count, motility, morphology and biometrics of sperm head lengths. The number of sperms present and their motility must be judged very guardedly as purely temporary or accidental factors may give rise to misinterpretations. The morphology of the spermatozoa, and especially of their heads, seems to be the best and most reliable indication of their fertilizing power. The relative number of abnormal heads emitted apparently gives a direct index of reproductive fitness of the individual. Thus, no man in the series with more than 20 per cent abnormal heads had a good breeding record. Of the simple functions of the obtained curves, the coefficient of variation is the most important and was seldom much above 11.0 in a normally fertile man; the upper physiologic limits of this function seems to be about 11.5. In every case where abnormal curves and coefficients of variation above the normal limits or a mathematically significant skewness were present, the man's breeding record was poor. In most cases the morphology of the semen and biometrical results ran parallel. In some cases only the morphology was bad in others only the biometrics; thus, neither a normal morphology nor a normal curve alone mean normal fertility, whereas an abnormal finding in either signifies a disturbance of spermatogenesis and, hence, of fertility. When the fertility sinks as low as 0.6 of the normal value, clinical sterility usually results. In this series spermatogenesis seemed to be most favorably influenced by sexual rest and improvement of the general physical condition of the patient.

W. B. SERBIN.

**Serdukoff, G.: Restorative Surgery of the Fallopian Tubes. Its Methods and Results, La Gynécologie, 31: 193, 1932.**

In the opinion of Serdukoff, tubal sterility in women is much more frequent than is commonly believed. The logical therapy of this form of sterility is surgical correction which may consist of salpingostomy, implantation, salpingolysis or a combination of these. However, every surgical intervention should be preceded by a Rubin test or hysterosalpingography for verification of the diagnosis and for localization of the obstruction. One must be certain that no infection or inflammation is present. At the time of operation, the permeability of the tubes should be checked up. The best

results are obtained after salpingostomy, for in the hands of some authors the incidence of success is 100 per cent. The incidence of favorable results after tubal implantation varies from 20 to 33 per cent and the technic of this operation is not difficult.

From fourteen to thirty days after operation the tubes should be insufflated or iodized oil should be injected into them by way of the uterus. When women conceive after these plastic operations it is best for them to be delivered in a hospital.

J. P. GREENHILL.

**Tschertok, R. A., and Schor, M. I.: Tubal Patency After Intrauterine Injection of Iodine, Monatschr. f. Geburtsh. u. Gynäk. 92: 186, 1932.**

In four women, Tschertok and Schor determined that the fallopian tubes were patent by means of the injection of lipiodized oil. They then injected 1½ c.c. of 5 per cent tincture of iodine into the uterine cavity and the subsequent use of lipiodol proved that the uterotubal junctions were obstructed. This constituted confirmation of anatomic studies previously made by the authors. They had found that the injection of iodine into the uterus resulted in obstruction of the uterine end of the tube by a plug of fibrin. This favored implantation of the fertilized ovum in the fallopian tube, thus leading to ectopic pregnancy. Salpingography revealed that the obstruction is temporary. However, since the injection of iodine for the purposes of inducing abortion is by no means uniformly successful, and since it may result in ectopic pregnancy and permanent sterility, the authors warn against its use.

J. P. GREENHILL.

**Vignes, H., and Baron, F.: Experimental Study on the Regeneration of Resected Tubes, Bull. de la Soc. d'obst. et de gynéc. 4: 225, 1931.**

It has been demonstrated that a healthy fallopian tube after being cut possesses a remarkable power of regeneration and this is possible even after ligation, double ligation and resection, and crushing. Vignes observed such an occurrence in a rabbit and decided to study this type of regeneration and see whether the ovaries exerted any influence on it. Vignes and Baron operated upon 30 rabbits. In two rabbits examined seventy days after resection of the uterotubal junction and ligation of the ends, the tubes were distended by a large amount of serous fluid. Seven other rabbits had the same operation but in addition both ovaries were removed. At the end of seventy days their tubes were also found to have regenerated. They also contained a fluid but only a minimal amount, not sufficient to distend the tubes. In a rabbit with only one ovary removed the result was the same as in those not castrated.

In all cases the regeneration was not quite complete. The author draws attention to two facts. First the constant formation of an aseptic hydrosalpinx which distends the tubes and perhaps aids in their regeneration. Secondly the fact that the regeneration is not influenced by the presence or absence of the ovaries, but there is a difference in the amount of fluid secreted following the removal of the ovaries.

J. P. GREENHILL.

**Fuchs, H., and Lork, E. C.: Roentgen Control of Tubal Sterilization, Monatschr. f. Geburtsh. u. Gynäk. 88: 199, 1931.**

In a series of 73 tubal sterilizations performed on private patients by one of the authors (Fuchs) in a period of twenty-six years he encountered only one failure. Fuchs and Lork believe that among all the tubal operations recommended for the purpose of sterilization two are especially noteworthy: The Madlener method of crushing the tubes, and the Menge-Stoeckel procedure in which the tubes are fixed in the inguinal canals extraperitoneally. During 1930 they performed 51 tubal sterilization operations and examined 35 of the women from three to nine months after opera-

tion by means of a salpingogram. In the series of 12 Madlener operations 5 were found to be failures anatomically and functionally, hence this procedure is not reliable. The strikingly large number of tubal pregnancies which follow the Madlener operation justify further restriction of this operation. The Menge operation appears to be satisfactory but requires more roentgenographic studies. The operation of radical removal of the tubes has proved to be free from failures according to salpingography but, clinically, failures have been reported following it. Hence the authors feel they must agree with Fraenkel's conclusions, that the only 100 per cent method of sterilization is removal of the fundus of the uterus together with both tubes.

J. P. GREENHILL.

**Naujoks, H.: Reversible ("Temporary") Sterilization of the Female by Crushing the Fallopian Tube, Zentralbl. f. Gynäk. 55: 81, 1931.**

Madlener's method of sterilization by means of crushing the tube and ligating doubly with nonabsorbable suture material was modified by Walthard, who included a slightly larger loop of tube in the clamp. The present author gives a further modification as follows: The tube is crushed with a clamp at the ampullic end, for a distance of at least 1 cm., care being taken to include both muscle and mucous layers. One must be sure that, although the tube is crushed, it is not cut or torn. It is then doubly ligated at each end of the crushed area with nonabsorbable suture material. The method is advantageous because it is quick, simple, and bloodless, and because it is easily reversible at a later date by simply cutting the tube between the proximal ligature and the uterus, either with a knife or an endotherm cautery.

WILLIAM F. MENGERT.

**Horneffer, L., and Meyerhoff, K.: The Question of Hormonal Sterilization, Zentralbl. f. Gynäk. 55: 473, 1931.**

It would be of great value to have an effective safe means of producing temporary sterilization. Reasoning that during pregnancy there must be some sort of substance which inhibits follicle development and ripening, the authors implanted ovaries taken from pregnant mice in the thigh muscles of four female mice. Two of these mice became pregnant after thirty-four and forty-three days, respectively, and the other two remained sterile for more than a year. The authors were also able to delay the appearance of heat in 21 mice by implanting an additional pair of ovaries, taken from nonpregnant mice, in the thigh muscles. However, they do not believe that these experiments present clear proof of hormonal sterilization and feel that further researches must be made to clarify the problem.

WILLIAM F. MENGERT.

**Mendelshtam and Tschalkovsky: Hormonal Sterilization of Animals, J. akush. i. zhensk. boliez. 42: 757, 1931.**

The authors used prolant of the Moscow Endocrinological Institute in which prolant B is predominating. Seventy-three female mice were injected with 10 mouse units of prolant in single dose. After four days they were put with male mice for mating and stayed together fifteen days, and then were separated. After twenty-four days (counting from the first day of mating) it was found that there were eleven pregnant mice. Of the sterile mice, three were killed. On histologic examination many corpora lutea (vera and atretica) were found.

Four days after injection of prolant in two control mice both ovaries were found luteinized. By this single injection of prolant the ovulation in mice was discontinued for five to six mouse cycles.

The authors think that prolant may some day be used for temporary sterilization of women.

ALEXANDER GABRIELIANZ.



**Tschaikowsky, V. K.:** Sterilization of Animals Without the Use of Hormones, *J. akush. i. zhensk. bolez.* 42: 758, 1931.

The author injected eleven female rabbits and eighty-nine mice three to four times with isogenic protein of placenta free from hormone. No rabbits became pregnant. After thirty-five days (from the first day of mating) only two mice were pregnant.

Injection of this same protein into pregnant rabbits led to abortion.

Histologic examination of ovaries revealed death of the ovum in all stages of ripening of the follicles. In the liver and kidneys no signs of toxicity were found. Some changes were found in the thyroid gland. Five rabbits were further observed in which sterility lasted from two to five months. The offspring of these animals were born at term and were healthy.

ALEXANDER GABRIELIANZ.

**Unbehaun:** The Effect of Nicotine on the Ovaries of White Mice, *Arch. f. Gynäk.* 147: 371, 1931.

The author found that subjecting white mice to nicotine poisoning resulted in the production of definite pathologic changes in the ovaries. Estrus was always definitely delayed. Histologically the ovaries, following nicotine poisoning, showed degenerative changes in the ripening follicles together with a definite decrease in the number of atretic follicles. The connective tissue of the interstitial portions of the ovaries was always definitely increased. Cyst formation was never found.

RALPH A. REIS.

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## AMERICAN BOARD OF OBSTETRICS AND GYNECOLOGY

The next written examination and review of case histories will be held in cities throughout this country and Canada where there are Diplomates who may be empowered to conduct the examination, on April 1, 1933.

The next general, clinical examination is to be held in Milwaukee on Tuesday, June 13, 1933, immediately preceding the annual session of the American Medical Association. Reduced railroad rates will apply.

The Diplomates of the American Board of Obstetrics and Gynecology in attendance at the coming scientific meeting of the American Medical Association in Milwaukee, June 14 to 16, will hold a dinner and Round Table Conference on the evening of the first day of the scientific session, June 14, at the Hotel Schroeder. At this dinner, the successful candidates certified at the preceding day's examination will be introduced in person. A short address will be made by one or more of the Board officers, and a general discussion of Board activities will follow. Diplomates of the Board are urged to attend and to bring any interested guests. The subscription for the dinner will be nominal and reservations may be made in advance through the Secretary's office.

Early application is requested from those desiring to qualify for these examinations. For further information and application blanks address the Secretary, 1015 Highland Building, Pittsburgh, Pennsylvania.





WILLIAM PHILLIPS GRAVES  
1870-1933

# American Journal of Obstetrics and Gynecology

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## IN MEMORIAM

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WILLIAM PHILLIPS GRAVES

1870-1933

WILLIAM Phillips Graves, a member of the Advisory Editorial Board of the JOURNAL, was born on January 29, 1870, at Andover, Massachusetts. His father was William Blair Graves, the head of the Department of Science at Phillips Academy and a descendant of John Graves, one of the early settlers in New Hampshire. His mother, Laurantah Hodges Copeland Graves is a descendant of Elijah Copeland who traced his ancestry to John Alden.

Dr. Graves received his preliminary education at Phillips Academy where he won several prizes in Latin and Greek as well as taking a leading part in the athletic and social activities of the school. In 1887 he entered Yale University, receiving mention in the catalogue as passing the second best entrance examination in Greek. At college he stood high in his classes, progressed from editor to editor-in-chief of the Yale Record, and became a versatile athlete. Although he was on many teams his fondest memory was that he played half-back on the famous Yale team of 1888 which had the unique record of scoring six hundred and ninety-eight points to the opponents' nothing.

Teaching was his decision for a career so he became an instructor at Hill School in the fall of 1891. While there he was the general athletic director and taught penmanship, Latin, history, English composition, and drawing. The drill that he received in some of those subjects is reflected in his perfect chirography, the excellent grammar and clarity of expression in his medical writings, and the beautiful illustrations drawn for the latter. Except for a year of post-graduate study at Harvard in 1893-94, the next four years were spent at Hill School.

He decided then to study medicine and become a surgeon in spite of being offered the position of vice-principal at the Hill School. He saved sufficient funds from teaching and tutoring in the summer to enable him to enter Harvard University Medical School in 1895. He worked his way

through by tutoring and winning a scholarship, showing his ability and energy by graduating at the head of his class with a *summa cum laude* degree in 1899. As a second year student he cut himself while doing an autopsy on a scarlet fever victim and nearly died from the hemorrhagic type of that disease.

After a year as interne at the Massachusetts General Hospital he married and went to Europe for study, principally in pathology under Störek at Vienna.

In 1902 a place was offered him at the Free Hospital for Women where he established the pathologic laboratory and then went to Baltimore and other cities for six months' study and observation. At Johns Hopkins he received inspiration from Kelly and Cullen as well as learning the technic of medical illustration from the famous Max Brödel.

His progress from then on was steady and brilliant. He became Surgeon-in-Chief to the Free Hospital for Women in 1908 from which he retired on reaching the age limit on January 1, 1933. He was the Professor of Gynecology in the Harvard University Medical School from 1911. The late Dr. William H. Baker left a fund establishing a professorship in gynecology to be known by his name to which Dr. Graves was appointed in 1926. He resigned this post in 1932, becoming Professor Emeritus.

Dr. Graves made many contributions to medical literature but his crowning achievement was the well planned, clearly written textbook on gynecology which first appeared in 1916. Its popularity may be gauged by the fact that it has been translated into other languages and that he was engaged in preparing the fifth edition at the time of his death.

He belonged to many medical societies, local, national, and foreign. Boston University honored him with the degree of Doctor of Science in June, 1932, and in December, 1932, he went to England to receive an honorary fellowship in the British College of Obstetricians and Gynecologists.

Soon after his return from England he contracted the prevalent acute infection of the "grippe" type but, with his characteristic sense of duty, he insisted on getting up to operate on a case already scheduled. That was evidently too great an exertion and after two weeks of acute illness he died on January 25, 1933. He is survived by his widow and three children, one of whom, Sidney C. Graves, had just started to practice in association with his father.

Dr. Graves' outstanding characteristics to his associates were his ceaseless energy based on a magnificent physique; his intense ambition to know all that there was to know about any subject that interested him; his tenacity in adhering to what he thought was right; and his conscientious care of his patients.

He was a man of many attributes, a first class surgeon, a good painter and modeler, and a person of wide culture. He was greatly interested in philosophy and psychology, writing and reading papers on those subjects.

Everything that he turned his mind to was studied thoroughly. For instance a lecture which he gave on the technic of golf some years ago was complete in every detail from subject matter to illustrations. His real avocation was to work just as hard at whatever attracted him as he did at his vocation. However when he felt free of care he was an extremely companionable man who enjoyed having a good time. His conscientiousness is illustrated by the many times that he gave up meetings of the American Gynecological Society and class reunions, to which he had looked forward with anticipation, because he felt that some sick patient needed his presence.

An excellent perspective of his career is given in these words of Professor Blair Bell when conferring the honorary fellowship in the British College of Obstetricians and Gynecologists. "Professor Graves. In this world of haste and hurry, conditions not unknown in your country, you stand out in our branch of medicine as a man of quiet contemplation, of wise discretion and of sober judgment. Your influence on the progress of obstetrics and gynecology has been profound, not only in the United States but wheresoever there exists a parcel-post for the transport of your classical works. You are an artist both in practice and in theory. The beautiful illustrations drawn by your own hand which adorn your papers and books are the admiration of all. You bring artistry to your craft. You are too a thinker and hidden under a deep reserve lie golden thoughts. In honoring you we honor obstetrics and gynecology."

—*Frank A. Pemberton.*

# Original Communications

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## LESIONS OF THE PLACENTAL VESSELS\*

THEIR RELATIONSHIP TO THE PATHOLOGY OF THE PLACENTA;  
THEIR EFFECT UPON FETAL MORBIDITY AND MORTALITY

THADDEUS L. MONTGOMERY, M.D., PHILADELPHIA, PA.

*(From the Department of Obstetrics, Jefferson Medical College Hospital)*

THE purpose of this paper is to describe certain lesions of the placental vessels, to discuss their relationship to other pathologic conditions in the placenta, and to consider their effect upon the morbidity and mortality of the fetus. The material which has been employed in the study consists of the placentas delivered in the Obstetrical Department of Jefferson Medical College Hospital during the past three years. Four hundred consecutively delivered placentas were subjected to microscopic study. From the remaining specimens, histologic sections were cut only in those instances in which there were obstetric complications or gross evidence of pathology. Of these there were 250.

Within the brief scope of the paper it is obviously impossible to include all the lesions which occur in the vascular structures of the placenta. I propose, therefore, to limit the discussion to acute inflammation and to certain alternative and obliterative lesions. The condition of the vessels in syphilis of the placenta will be dealt with at another time.

### ACUTE INFLAMMATION

Our knowledge of acute inflammation of the placenta has been enhanced by the contributions of Warnekros, Siddall, Slemons and others. A number of enlightening papers have been published in recent years. Special staining methods have revealed the presence of bacteria, frequently of a pathogenic type, in association with the histologic lesions. In a contribution to the mechanism of intrauterine infection and to the pathogenesis of placentitis, Kobak has made a careful study of the histopathology, and has recorded the results of cultures collected from the fetal cord blood. In many instances he demonstrated the presence of pathogenic organisms in the blood stream of the newborn child. Wohlwill has discussed the condition, with particular attention to its occurrence in abortion.

In our own series acute inflammation of the membranes, of the placenta or of the cord vessels was found in 67 specimens, or 10 per cent of the 650 placentas. The first site of inflammatory reaction occurs in the mem-

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\*Read at a meeting of the Philadelphia Obstetrical Society, May 5, 1932.

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NOTE: The Editor accepts no responsibility for the views and statements of authors as published in their "Original Communications."

branes, particularly at the margin of the aperture and adjacent to the cervical os. The inflammation is evidenced by a polymorphonuclear leucocytic infiltration of the subamniotic and chorionic layers (Fig. 1). In the mild cases there is no evidence of extension to the placental tissue. In

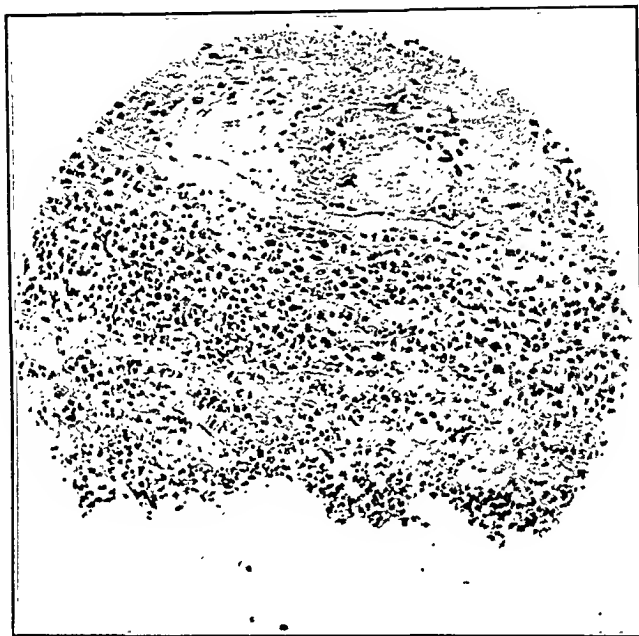


Fig. 1.—Acute inflammation of the membranes. Extensive polymorphonuclear leucocytic infiltration and fibrinous deposit as revealed under the high power objective. (Photomicrograph 207X.)



Fig. 2.—Inflammation of the margin of the placenta. Light leucocytic infiltration extending from the membranes to the corresponding layers of the margin of the placenta. (Photomicrograph 57X.)



the moderately advanced cases of acute inflammation, the inflammatory reaction extends to the margin of the placenta and involves the corresponding layers of the latter organ (Fig. 2). The reaction extends only a short distance along the decidual layer of the placenta, but is found almost uniformly throughout the subamniotic tissue. The blood vessels which trace across the fetal surface of the placenta are frequently involved (Fig. 3).



Fig. 3.—Acute inflammation of a large placental vessel. Leucocytic infiltration of the intima, the muscle wall, and the perivascular tissue. (Photomicrograph 40X.)

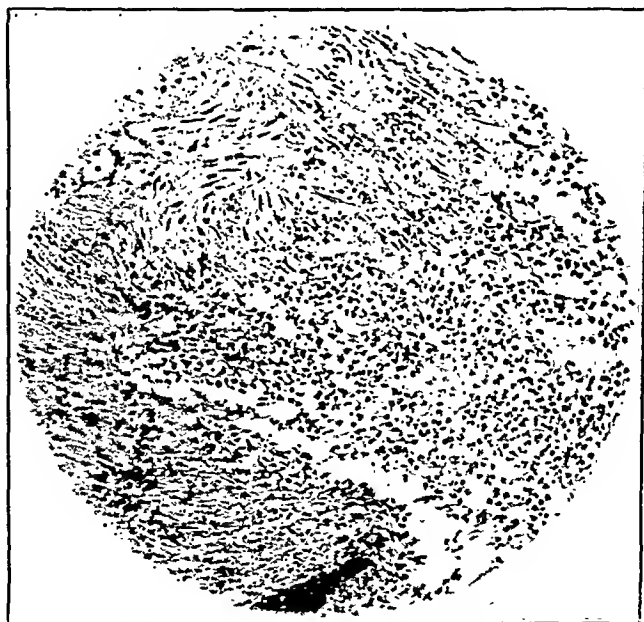


Fig. 4.—Acute thrombophlebitis of cord vein. Leucocytic infiltration in the interstices of the muscle wall and intima. Meshwork of fibrin and leucocytes projecting into the vessel lumen. (Photomicrograph 227X.)

Leucocytes occupy the tissue spaces between the muscle fibers of the vessels and are concentrated in the intima. In the moderately developed cases of acute inflammation, the cord vessels are also involved; the vein is first to show inflammatory reaction; often times the other cord vessels remain unaffected. Inflammatory reaction in the vein is similar in appearance to that in the vessels of the placenta.

If the inflammation is more severe and extensive, thrombosis takes place. The cord vein always contains a more advanced grade of thrombosis than the arteries (Fig. 4). As a general rule the placental villi, villous capillaries, and small vessels of the villous stems are free of inflammatory reaction.



Fig. 5.—Focal necrosis of placental villus. Fibrin deposit surrounding a villous stem in which the vessel is of normal histologic structure. (Photomicrograph 230X.)  
A. Fibrin deposit. B. Normal villous vessel.

Judging from the observations of others and from a consideration of our own cases, it appears that this acute inflammation in the fullterm placenta and cord vessels develops during the course of labor and is the result of an intrapartum infection. Premature rupture of the membranes, prolonged labor, difficult labor with operative vaginal delivery, and repeated vaginal examination constitute important predisposing factors. The condition is often associated with an intrapartum fever. In abortion and miscarriage the occurrence of inflammation is relatively more frequent than in fullterm labor.

Considering the nature of the process, particularly in those instances in which particles of thrombi become detached from the cord vein and enter the fetal circulation, an increase in morbidity and mortality of the fetus is to be expected. As a matter of fact, it is surprising that a great many more babies do not succumb to the effect of the bacteremia. In those in-

stances in which death of the newborn occurs, it is usually difficult to decide whether the fatal outcome is the result of prolonged labor and difficult vaginal delivery, or the result of the placental bacteremia. In some instances it appears that the two factors are conjointly responsible.

In one of the most severe cases of placental and cord inflammation which I encountered in the series, the patient had been in labor for twenty-four hours on the outside, had been subjected to several vaginal examinations and an attempt at forceps delivery, and was eventually delivered by forceps in the hospital. The baby succumbed two days later. Autopsy revealed the presence of a purulent collection in the anterior lobe of the brain and multiple pyemic foci in the lungs. In this instance cerebral trauma

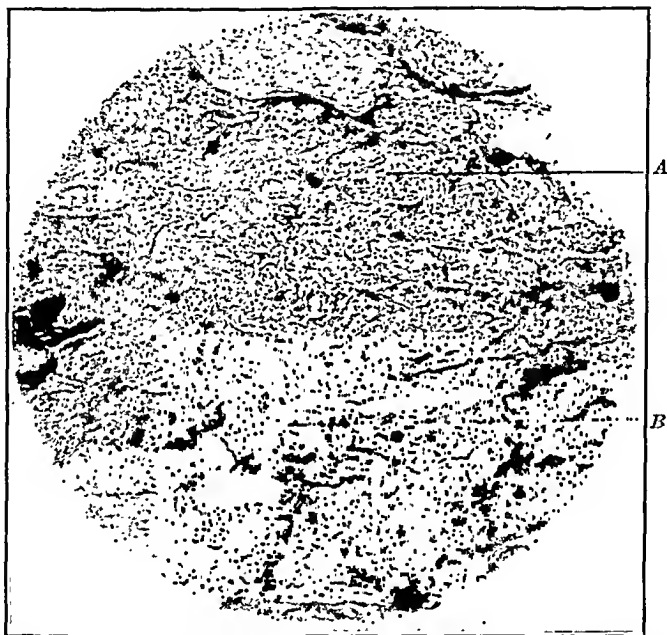


Fig. 6.—Conglomerate necrosis (infarction) of the placenta. Group of villi amalgamated by fibrin deposit, their syncytial covering lost and the stroma degenerated. (Photomicrograph 92X.) A. Degenerated villi. B. Fibrin deposit.

formed a nidus for the lodgement of the organisms which were present in the fetal circulation during the course of labor.

That a fatal outcome for the baby does not occur more often is attributable to the facility with which fetal tissues destroy and eliminate bacteria from the blood stream. When the cord is ligated and the fetus detached from the source of the bacteremia the dangerous period of the infection is passed.

#### ALTERATIVE AND OBLITERATIVE LESIONS

Those lesions of the placental vessels which are of a chronic nature, the alterative and obliterative types, require more careful consideration. The presence of such vessel changes has long been recognized. In 1897 Eden wrote a splendid description of the histologic picture of endarteritis obliterans of the placenta, a description to which little can be added.

However, as to the significance of these chronic lesions and their relationship to other pathologic conditions of the placenta, much remains to be said. Eden and others considered endarteritis obliterans a cause of "infarction" of the placenta. Various other placental disturbances, and intrauterine death of the fetus were ascribed to the same cause. The dictum was formulated that a placenta is as old as its blood vessels. Thus the life cycle of the placenta was described in terms of vessel sclerosis and obliteration. It is with such problems that the remainder of my paper is concerned.

There are certain areas of the normal placenta and certain lesions of the placenta in which "chronic" vascular changes are frequently found. At

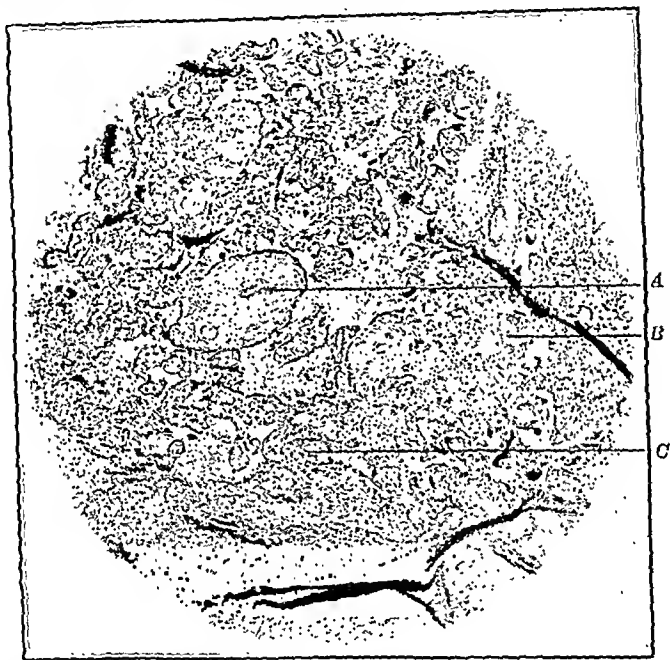


Fig. 7.—Necrosis at the margin of the placenta. Note particularly the obliterative changes in the vessels of this zone. (Photomicrograph 57X.) A. Physiologic obliteration of placental vessel. B. Fibrin deposit. C. Degenerated villi.

the margin of every fullterm normal placenta, there is recognizable a zone indicating the point of transition from the chorion frondosum, which later becomes the fully developed placenta, to the chorion laeve, which later enters into the formation of the membranes. In this zone there are present degenerated villi associated with intervillous fibrin deposit. The fetal vessels in such areas are either completely obliterated or greatly reduced in caliber (Fig. 7). Apparently, the vessel obliteration is due to collapse of the muscle wall and growth of the intima until the lumen is completely obliterated. Frequently the obliterated vessels in this region have undergone such extensive hyalin degeneration as to make it impossible to recognize any detailed structure of the vessel.

Another site in which vessel alterations are observed is the conglomerate necrosis (infarction) of the fullterm placenta. Microscopic study of such

areas reveals a hyaline degeneration of the villous stroma, a loss of, or necrosis of the overlying chorionic epithelium, and a dense deposit of fibrin in the intervillous space (Fig. 6). The vessels in such areas are usually small in caliber, the lumina are obliterated or greatly reduced in size, granular and hyalin degeneration are present in the muscle wall, and frequently a growth of the lining intima completely seals the vessel lumen. Occasionally, however, vessels which are normal in size and which contain a few degenerated red blood cells are observed. Such areas of necrosis are present so uniformly in fullterm placentas that the lesions are considered physiologic.

There are, however, similar but more extensive lesions of placental

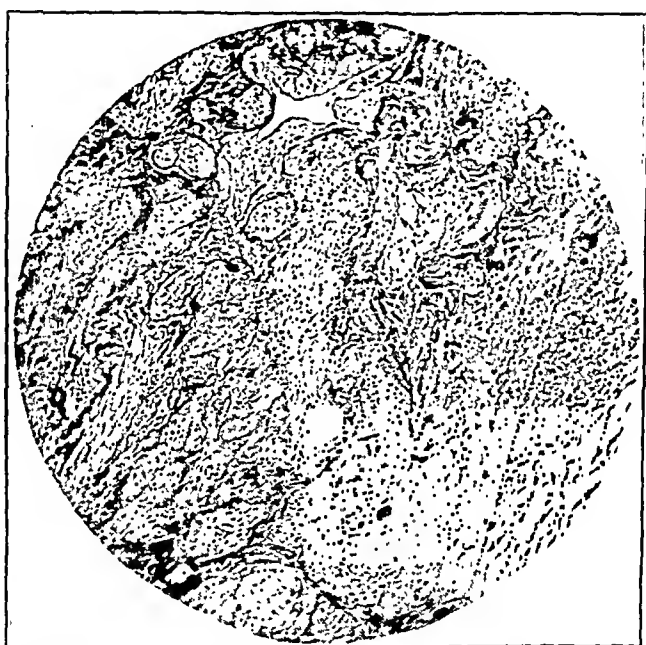


Fig. 8.—Histologic structure of the placenta of missed abortion. The villi are large, of the immature type. The chorionic epithelium has been destroyed. Intervillous fibrin deposit is extensive. (Photomicrograph 72X.)

necrosis which interfere with the growth and vitality of the fetus. They are associated with certain instances of missed abortion, with massive infarction of the placenta and intrauterine death of the fetus, and with intrauterine death of one of the fetuses of binovular twins.

In the presence of large areas of necrosis of the placenta, the functional capacity of the organ is so decreased as to lead either to immaturity or to intrauterine death of the fetus. The placental vessels which supply these areas are either collapsed or obliterated, revealing endovascular alteration. The larger the area of "infarction," the larger the vessels that are involved. In such instances when the vessels of the placenta are distended with an opaque fluid, the x-ray reveals areas in which circulation is absent (Fraser).

A similar appearance is found in certain cases of missed abortion. A

photomicrograph which I present in this series is taken from a specimen of missed abortion which was secured at five lunar months. At four lunar months the uterus ceased to grow, and during the last month decreased progressively in size. The Aschheim-Zondek and Mazer-Hoffman tests, which had been positive early in pregnancy, became negative. Sensation of movement which had been experienced in slight degree disappeared. The patient experienced no abdominal pain and no vaginal bleeding. The contents of the uterus were removed by dilatation and evacuation and a small mummified fetus and necrotic placenta obtained. The placenta reveals upon microscopic examination changes quite similar to those of massive necrosis of the fullterm placenta. The villi are large in construction,

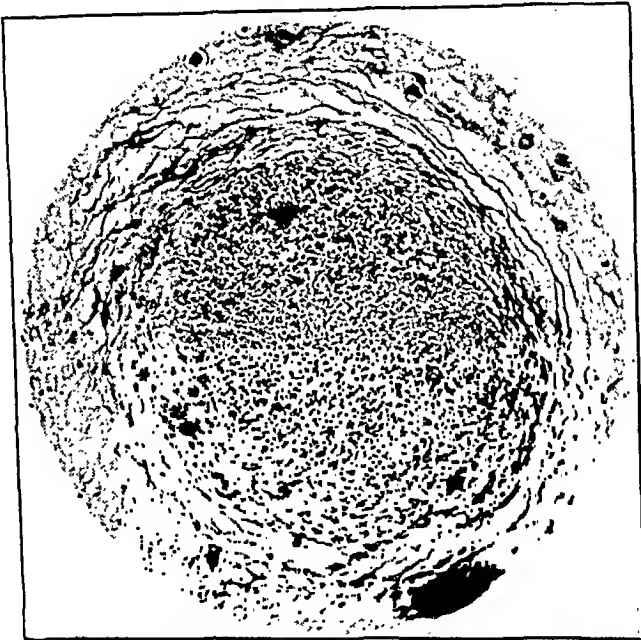


Fig. 9.—Vascular lesion in placenta of missed abortion. The intima is thickened. Fibroblasts are invading the vessel lumen, and inaugurating the process of organization. (Photomicrograph 102X.)

such as one expects to find in an early pregnancy, and have undergone complete hyalin degeneration (Fig. 8). The intervillous deposit is quite heavy, and obliterative changes have begun to take place in the fetal vessels. In many instances the degenerative process is so marked that the anatomic details of the vessel are obliterated. In the instance of one of the larger subamniotic vessels of the placenta the growth of new tissue arising from the intima is quite well shown (Fig. 9).

In addition to these several examples, there have occurred during the last eighteen months four instances of binovular pregnancies in which one fetus was born alive at or near term, with a corresponding normal placenta, while the other fetus was born dead, macerated and compressed, attached by a necrotic cord to a placenta which was extensively degenerated. Of the two specimens of this condition which I wish to present one was ob-

tained from a case of binovular twins and the second from an instance of binovular triplets (Fig. 12). In the instance of the binovular twins the contrast between the histology of the normal placenta and the degenerated placenta is clearly shown in Figs. 10 and 11. In the instance of the binov-



Fig. 10.—Histologic section of the undegenerated placenta of binovular twins. The villous stroma is slightly more dense than in the average fullterm placenta, but there is no evidence of necrosis of the chorionic epithelium. (Photomicrograph 156X.)

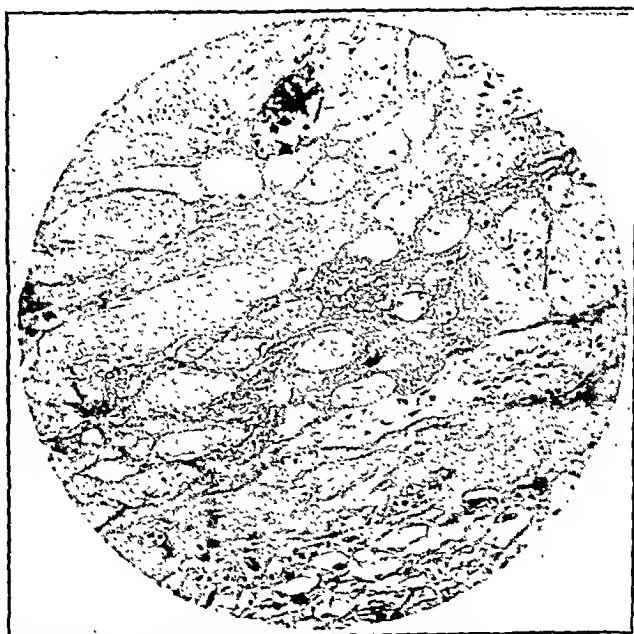


Fig. 11.—Histologic section of degenerated placenta of binovular twins. The syncytium has been lost. Intervillous deposit is extensive. There is hyalin degeneration of the villous stroma. (Photomicrograph 72X.)

ular triplets the living child was born at full term and a few moments later two other degenerated and necrotic fetuses were expelled. Upon delivery of the placentas it was found that the dead fetuses were attached to a single placenta in which the circulations communicated, while the living fetus was attached to an entirely separate placenta (Fig. 12). All were of the male sex. The photomicrographs show quite distinctly the difference in character of the two placentas; one revealing the normal delicate structure of the placental villi and vessels, the other a granular degeneration of the chorionic epithelium with calcareous deposits on the surface of the villi (Figs. 13 and 14).

In the specimen of the degenerated placenta of triplets there are revealed so clearly the various stages of obliteration of placental vessels, that



Fig. 12.—The macerated fetuses and the placentas from binovular triplets. The dead fetuses are attached to a single placenta which is small, smooth, thin, and indurated. To the larger placenta the living fetus was attached.

I have chosen from it several sections. The photomicrograph discloses a growth of intimal cells which either reduce the caliber of the vessel to several small channels, or practically obliterate the lumen (Fig. 15).

These cases are representative of rather numerous instances, in which, with extensive necrosis of the placenta a profound effect upon the vitality of the fetus is encountered.

It is much easier to demonstrate the existing pathology than it is to account for the mechanism of its production. After studying these conditions carefully from the standpoints of clinical observation and histologic examination there are certain views which I, nevertheless, desire to present.

In the first place, I am forced to disagree with the conception that these lesions are the result of, or secondary to the atrophic and obliterative changes in the placental vessels. In this connection I would refer briefly to



a previous paper in which this matter was discussed (Montgomery). I am now rather decidedly of the opinion that the life cycle of the placenta is written, not in terms of vessel change, but in terms of the aggression and regression of the chorionic epithelium. The life cycle and the nutrition of the chorionic epithelium appear to be independent of the fluid in the fetal

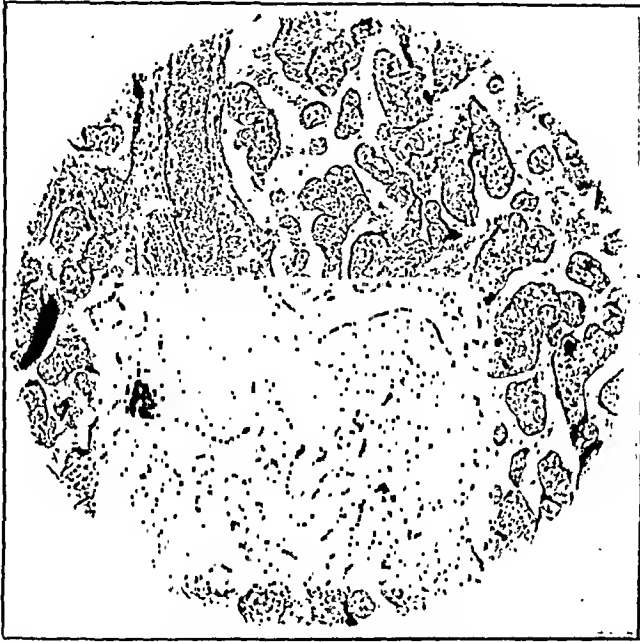


Fig. 13.—Structure of the undegenerated placenta in binovular triplets. Note the normal delicate architecture of the placental vessels and villi. (Photomicrograph 80X.)



Fig. 14.—Structure of the degenerated placenta in binovular triplets. Granular degeneration and hyaline necrosis of the chorionic epithelium and villous stroma with numerous areas of calcareous deposit. (Photomicrograph 127X.)

vessels. Numerous observations confirm this conclusion. In the first place, at the time when the trophoblast is most active and the cellular hyperplasia of the ectoderm most marked, there are no fetal vessels present in the mesoblastic core. In the second place, the chorionic epithelium appears capable of sustained life when it is detached from the villous core, as demonstrable in tubal pregnancy and chorionepithelioma. In the third place, in certain conditions, such as syphilis of the placenta, in which the villous capillaries are quite small and apparently inadequate in size, the chorionic epithelium retains its vitality. Finally, in the examination of early cases of focal necrosis of the placenta, degeneration of the syncytium and fibrin deposit occur on villi in which the villous circulation is undisturbed (Fig. 5).

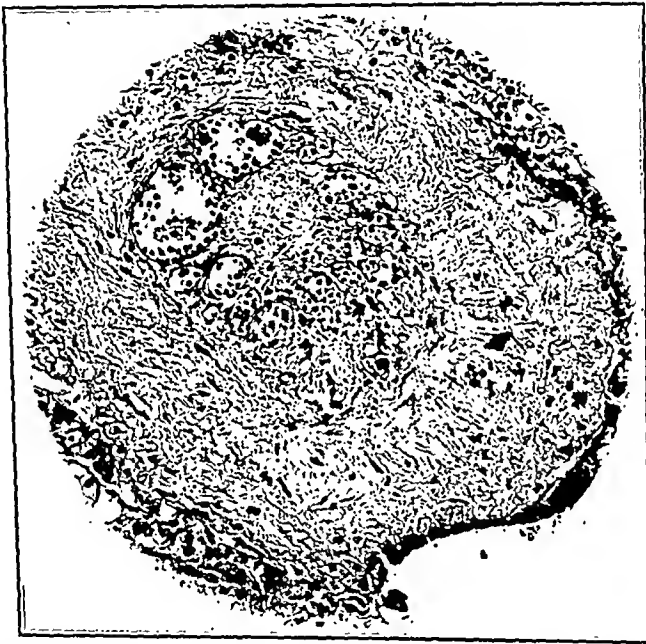


Fig. 15.—Endovascularitis of placental vessel. The growth of vascular connective tissue has reduced the lumen of the vessel to several small endothelial lined channels. (Photomicrograph 207X from the necrotic placenta of the binovular triplets.)

The active growth of the trophoblast during the early period of pregnancy, the gradual loss of activity during the mid-period of pregnancy and, finally, the thinning out and atrophic change in the chorionic epithelium in the latter part of pregnancy constitute one of the numerous cyclical phenomena which characterize the higher animal.

When the chorionic epithelium is subjected to conditions which impair its growth activity or withhold its nutrition, pathologic disturbances, such as extensive necrosis, take place. The parenchymatous structure of the placenta is then destroyed, either in local or widely diffused areas. The collapse and obliteration of the corresponding placental vessels occur secondarily and constitute a readjustment of the amount of circulating blood to the decreased circulatory requirements. This interpretation is in

keeping with our present knowledge of the physiology of reproduction and can be applied to each of the types of placental necrosis which have been considered.

The necrosis which is found at the margin of the placenta is the result of inadequate nutrition at the zone of transition between the richly vascularized decidua serotina and the thin, poorly vascularized decidua capsularis. The villi in and adjacent to the chorion laeve undergo, in reality, starvation necrosis; the associated fetal vessels, a gradual and complete secondary obliteration.

"Infarction" of the fullterm placenta is due to the fact that the chorionic epithelium has at this period of pregnancy undergone such extensive regression that it no longer acts as an adequate vascular lining to the intervillous spaces. As a result, areas of fibrin deposit take place upon the exposed and degenerated surfaces of the villi. When such areas extend, large groups of villi are thrown out of function and the corresponding fetal vessels collapse and undergo degenerative and obliterative changes.

These two lesions, necrosis of the margin of the placenta and "infarction" of the fullterm placenta, are considered normal manifestations of the life history of the organ. However, a consideration of those necrotic lesions which give rise to missed abortion, intrauterine death of the fetus, and to the death of one of binovular twins, impresses one with the fact that he is dealing in these instances with notable departures from the normal.

In explanation of the etiology of such abnormalities several factors must be considered. The first of these is that the endometrium may be improperly prepared for the reception of the ovum, or that the decidual bed may be subsequently impoverished by degeneration or by thrombosis of the uterine vessels. Recent studies in obstetric and gynecologic physiology have demonstrated how necessary it is that the endometrium be properly prepared for the reception and implantation of the fertilized ovum. Normal corpus luteum secretion appears essential for the development of the pregravid stage of the endometrium and for the continuance of pregnancy, at least during the early weeks. Comparatively little is known, however, of the part that this and other internal secretions play in the further maintenance of the intrauterine life of the fetus.

Practical experience, however, demonstrates how essential the activity of the thyroid gland is in the maintenance of normal fetal growth. For example, obstetricians generally have found the empiric use of iodine or thyroid extract of value in promoting fullterm pregnancy, particularly in those patients who have repeatedly suffered abortions or stillbirths.

It appears problematic, however, whether the character of the site of implantation alone governs the nidation and normal growth of the ovum. For instance, in placenta accreta the normal decidual layer between the epithelium and the uterine musculature is absent. In those instances where the chorionic epithelium is hyperactive, namely, in chorionepithelioma and in hydatidiform mole, the epithelial cells invade all tissues with

little respect for previous preparation. Indeed, if internal secretions and their effect upon the implantation site of the placenta are alone responsible for the growth of regression of the placenta, why should the line of differentiation be so clearly marked between the necrotic placenta and the normal placenta of binovular twins? In the one case there is a completely normal placenta and in the other there is a uniformly degenerated placenta.

The character of these various lesions suggests that the ability of the fertilized ovum to grow and maintain its existence in the uterus is dependent not only on the site of implantation, but also on the innate nature of the germ plasm. The latter conception offers a more reasonable explanation of those instances in which early necrosis of the placenta takes place with missed abortion, and of those instances in which the one fertilized ovum of binovular twins proceeds normally in its growth, while the other fertilized ovum advances only to a limited stage of development and succumbs. Some such explanation also lies at the foundation of chorionepithelioma, in which the growth impulse of the fertilized ovum and its derivatives far exceeds the normal.

These matters require experimental study. It is of the greatest importance to determine if the internal secretions of the anterior lobe of the hypophysis and thyroid gland which appear so necessary in the preparation of pregravid endometrium are equally necessary for the activation and sustained growth of the ovum and its derivatives.

While it appears manifest that placental vessel obstruction is not the cause of necrosis of the placenta, nevertheless for the confirmation of more rational conceptions, further biologic studies are essential.

#### SUMMARY

1. A brief outline of the acute inflammatory reactions of the placenta and placental vessels has been presented. It has been shown that the milder types of acute inflammation begin in the membranes. The margin of the placenta and the amniotic surfaces of the placenta are next involved. When the inflammation is more advanced, a leucocytic infiltration of the placental vessels and cord vessels takes place; in the severe or extensive types of inflammation, thrombosis occurs. Only in the most severe types of inflammation does the condition in the placenta react unfavorably on the child.

2. Certain placental vessel lesions of an alterative or obliterative type have been studied. They are found present with necrosis of the placenta. The vessel lesions appear secondary to degeneration of the chorionic epithelium rather than primary. This is true not only when necrosis is of the so-called physiologic type, but also when it is so extensive as to impair the vitality of the embryo.

3. The dictum that "the placenta is as old as its vessels" is not applicable; in reality, the placenta is as old as its chorionic epithelium.

4. Certain views are presented as to the cause of premature and exten-

sive necrosis of the placenta. These are based upon clinical and histologic studies. The most likely explanation appears that the fertilized ovum, either because of hereditary influences or because of the effect of internal secretions, departs from the normal in its growth activity. This departure from normal may be in the direction of a short life cycle to eventuate in premature necrosis, or in the direction of rapid growth and hyperplasia to produce hydatidiform mole and chorionepithelioma.

*Acknowledgement.*—I wish to express my gratitude to Dr. P. B. Bland for the constant interest and encouragement he has shown, and for the aid in providing materials and technical help to conduct these investigations.

I am also deeply indebted to the personnel of the Laboratories of Pathology of the Jefferson Medical College Hospital for their assistance, particularly the Director, Dr. Baxter L. Crawford, and his associate, Dr. Carl J. Bucher.

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1930 CHESTNUT STREET.

#### ABSTRACT OF DISCUSSION

DR. FRANKLIN L. PAYNE.—It was interesting to look up at the Philadelphia Lying-in Hospital records of these patients who had been in labor over twelve hours with ruptured membranes. During the last eighteen months, of 3541 deliveries, 44 such cases were found. There were four fetal deaths: (1) prolapsed cord, (1) macerated, (1) hydrocephalic, (1) breach, which at autopsy showed tentorial tears. None of these could be ascribed to bacteremia. From these figures I believe we can deduce that the danger is not so much to the infant as to the mother.

In discussing the death of one of binovular twins, Dr. Montgomery offers the suggestion of an endocrinal influence. It is difficult to conceive one endocrinal influence upon one growing fetus, and the reverse upon the other. As to the innate strength of one ovum, and the innate weakness of the other, I cannot conceive of two ova cast off about the same time possessing such a difference in vitality. I prefer to look upon the death of the second of the twins as the result of some decidual change, some lack of nutrition from the maternal side, or possibly of undue pressure caused by the other growing fetus and placenta.

DR. MONTGOMERY (concluding).—In reply to Dr. Payne, I can only say that an estimation of the hereditary factors at play in embryonic growth must include a consideration of not only the chromosome elements which are derived from the ovum, but also those which are derived from the spermatozoon. It is not unexpected that differences in growth activity of fertilized ova may manifest themselves in early embryonic life in

the same fashion that differences in health and resistance may be manifested in childhood and in maturity.

I have in mind a patient whom I recently attended in her sixth pregnancy. Five previous pregnancies by her first husband had resulted in either miscarriage, stillbirth, or neonatal death. Her first husband was tuberculous. While the tuberculosis itself may have played no part in the actual heredity of the fertilized ovum, nevertheless, the sixth pregnancy, which was by a second husband, was comparatively normal and resulted in a normal living baby.

The evidence which has been presented in the course of this paper is by no means adequate proof of the influence of hereditary factors upon the growth activity of the chorionic epithelium, but certainly it has a significance which must be given thoughtful consideration.

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## A CLINICAL STUDY OF 100 CASES OF DEVELOPMENTAL AND FUNCTIONAL DEFICIENCIES IN THE FEMALE WITH ANALYSIS OF TREATMENT AND RESULTS\*

W. H. CARY, M.D., NEW YORK, N. Y.

**D**URING this epic of gynecologic progress when those engaged in animal experimentation are dominating the literature with highly important contributions bearing upon the influence of the endocrines in reproductive development and function, it seems fitting to present a purely clinical analysis of the sequelae of underdevelopment encountered in private patients presenting a condition of sterility, in an effort to determine what relation these deficiencies bear to human fertility and to consider the susceptibility of these cases to successful treatment.

To this end I am presenting a detailed study of a complete series of 100 problems in which structural and functional deficiencies of *probable* hypogonadic origin have been encountered in the female as a chief or concomitant etiologic factor. Each of these case histories has been itemized under 18 headings which include a classification of the general physical type (femininity), their health during adolescence (puberty), their past and present menstrual history, a notation of all anatomical abnormalities commonly attributed to underdevelopment, a history of their response to sexual stimuli, a record of concomitant causes of sterility (major in several instances), the method of treatment pursued, the results obtained as to pregnancy, and many miscellaneous items which bear an interesting relation to this subject.

The parallel tabulation of anatomical and functional phenomena seems warranted by their frequent association on the work-sheets (58 per cent), but it is appreciated that the former are static and factual while the latter are dynamic and variable and that a common causative factor is still hypothetical. As I had no thesis to prove, the statistics were accumulated without conscious prejudice or bias. The entries were made as noted on the histories and when completed the totals were computed. A deep interest

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\*Read at a meeting of the New York Obstetrical Society, May 11, 1932.

in this subject stimulated especially conscientious study. Except in cases referred for consultation or out-of-town patients with limited time, the final entries represent the results of repeated studies and when in doubt as to any item a negative notation was made, for it is accepted that statistical presentation of unreliable material is more dangerous than the application of balanced judgment to material without statistical analysis. A small percentage of error in the findings is unavoidable owing to the fact that 16 per cent of these patients had been operated upon before consulting the writer, two having had laparotomies and 13 others having undergone a total of 16 minor operations.

In this general group study, essentially preliminary in character, extensive and at this time impractical charts would be required to correlate the items appearing under individual headings. Some of the accompanying charts have the weakness of most statistical tables in that they are quantitative rather than qualitative. It is assumed that the reader can and will make his own deductions from the material presented. Certain conclusions which are not entirely obvious by the tabulation but seemingly justified by clinical experience and a knowledge of the intensity as well as the frequency of potential factors will, however, be mentioned.

#### GENERAL CONCLUSIONS

The structural and functional anomalies which are listed constitute the major causes or concomitant phenomena in approximately 24 per cent of the sterility cases encountered in general gynecologic practice and in more than half of the patients who now reach the special worker in this field. Clinical observation indicates that no common anatomical deformity such as ante flexion or hypoplasia of the uterus bears any constant causative relation to failure of conception. The extent of the lesion is of much importance. Varying degrees of hypoplasia were recorded in 60 per cent of the successful cases, and uterine flexions and displacements of the so-called congenital type were noted in 48 per cent. Neither do menstrual deficiencies, alone or in conjunction with hypoplasias, present a reliable index to defective ovigenesis, and the work of Hartman, Corner, Novak and others has demonstrated in higher primates a clinical impression long entertained by me that menstruation is not an invariable proof of normal ovulation. Academically, such factors may be interpreted as features of a symptom complex. In sterility work, however, each factor must be considered separately in a complete diagnostic study which, by direct demonstration or by exclusion, appraises its etiologic significance and thus points the way to logical treatment. The analysis shows that successful results may be obtained in many cases with marked menstrual deficiencies, if we do not permit our attention to be so focused upon assumed ovarian dysfunction as to neglect the study and treatment of other potential factors. Some degree of menstrual deficiency was reported in 70 per cent of the patients who became pregnant after treatment and in 50 per cent of the

successful cases both functional and anatomical defects were tabulated. We must face the fact, however, that retardation of sexual development, whether resulting from adverse conditions of early adolescence or responding to fixed laws of heredity, may so involve the gonads of certain individuals as to forever arrest their seed-producing function. This condition, which is not demonstrable in the female and can be inferred only by excluding other known barriers to fertility, doubtless accounts for some of our failures in the underdevelopment group. Frank<sup>1</sup> states, in the summary of his ovarian hormone studies that the findings do not offer an accurate guide to prognosis in sterility.

Experience would suggest that many of these patients produce normal ova at infrequent intervals and therefore marital relations with a husband of vigorous fertility constitutes an important factor in prognosis. In this group of problems it is most important to recognize the lesser degrees of seminal defects.\* The term "fertility" like "health" is a relative one and attempts to increase the impregnating power of the male specimen was considered an important supplementary procedure in 10 cases of this series. Finer measures† of sperm cell energy are needed.

The statistics as to results (Table IV) show that many cases in this series (39.7 per cent) when managed in accordance with the above principles presented an opportunity for successful treatment.

#### GLANDULAR THERAPY

While glandular products were used as supplementary treatment in 13 of these cases they are not regarded as a major factor in success in a single instance. This observation may indicate a lack of knowledge in the use of remedies highly regarded by many gynecologists<sup>2</sup> or a bias in the confused problems of interpretation.

For example, in a case which came to me several weeks subsequent to careful study in excellent hands, the wife was found to have a congenitally shortened vagina and a hypoplastic uterus in unyielding but symptomless retroversion-flexion. The tubes were patent at normal pressure. Prompt semen loss with defective sperm migration was demonstrated. The husband, though of active mentality, was sluggish physically and sexually. His metabolism, as well as the wife's, was moderately deficient and the semen while rated potentially fecundating was entered as subnormal, as were also his secondary sexual attributes. He neglected all treatment except for continuous thyroid administration. The wife, who had already undergone two minor operations and had now been urged to have a laparotomy was sustained in her refusal of the latter by both the family physician and myself. In appreciative confirmation of the diagnostic attitude, this woman recently reported that pregnancy had occurred after four months' marital relations with a different mate. The lessons taught include the realization that had the operation been done and pregnancy occurred while the first husband continued under medical care an accurate conclusion as to the most important factor in successful treatment would have been difficult.

\*Read, from an extensive urologic investigation, has pointed out the importance of chronic nonspecific and otherwise symptomless prostatitis as a cause of impaired fertility.

†The veterinary workers have superior opportunities in this field, and their observations are being investigated with reference to human fertility by Moench and others. *Moench and Holt: J. Lab. & Clin. Med.* 17: p. 297, 1931.



Chief reliance has been placed on thyroid substance, and though menstrual irregularities have thus been improved it has not, in my opinion, brought success in any case of this series. Limited experience with metabolism studies has given the reporter reason to believe that the findings are varied by many extraneous influences, that when carefully made they are sometimes in conflict with the clinical data, and that the latter should not be too readily subordinated. While I am watching with admiration and interest the work being done in ovarian and pituitary hormone determinations, this study has not as yet been recommended to infertile patients, because those who have contributed most to our scientific information in this field, have also demonstrated the difficulties which still obtain in applying this knowledge to the clinical management of sterility.

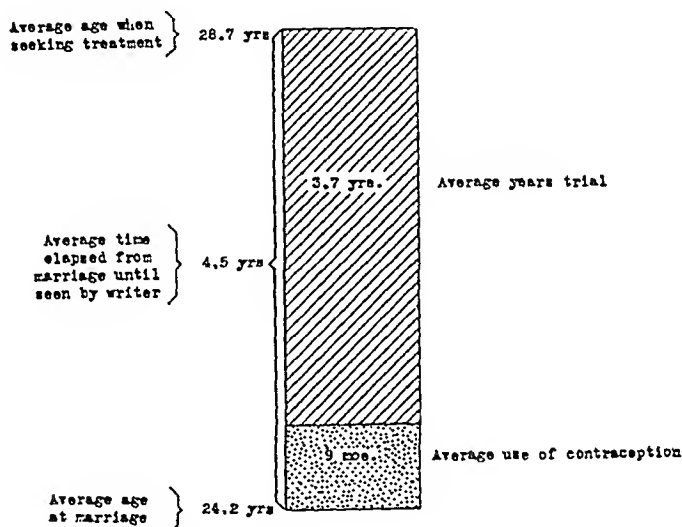


Fig. 1.—Average duration of marriage and infertility.

#### GENERAL DATA

The average age of these patients when they consulted me was 28.7 years (Fig. 1). The ages varied from a minimum of twenty-three to thirty-eight years and one success was obtained at this maximum age. Any conclusion as to the relation of age to prognosis is impossible at this time. The average duration of marriage was four and one-half years, giving an average marriage age of approximately twenty-four years. Contraception had been practiced for an average period of nine months, the term of "pregnancy try," therefore, being three and seven-tenths years. Sterility was primary in 91 couples (Fig. 2), while secondary sterility was due to abortion (probably spontaneous) in 6 instances. In one of the remaining cases hyperinvolution and prolonged amenorrhea had followed the first pregnancy, in another case the first pregnancy had been terminated by cesarean section for acute hyperthyroidism, the latter symptoms persisting moderately in spite of thyroid surgery and were complicated by uterine atrophy and menstrual irregularity; and in the final parous case, one-

child sterility with functional deficiencies was also reported in the two preceding generations.

#### PHYSICAL TYPES

As data relative to interrelation of the gonads with other glands and the clinical concepts of their dysfunction are being constantly revised, these patients were classified simply with reference to marked variations from our impression of the normal feminine type: groups familiar to any observant physician. Overweight is recorded in 12 instances, not the obesity often seen in careless clinical patients but devotees of the mode who in spite of normal inheritance and intelligent effort gained weight rapidly at puberty, after marriage, or coincident with menstrual deficiencies. In

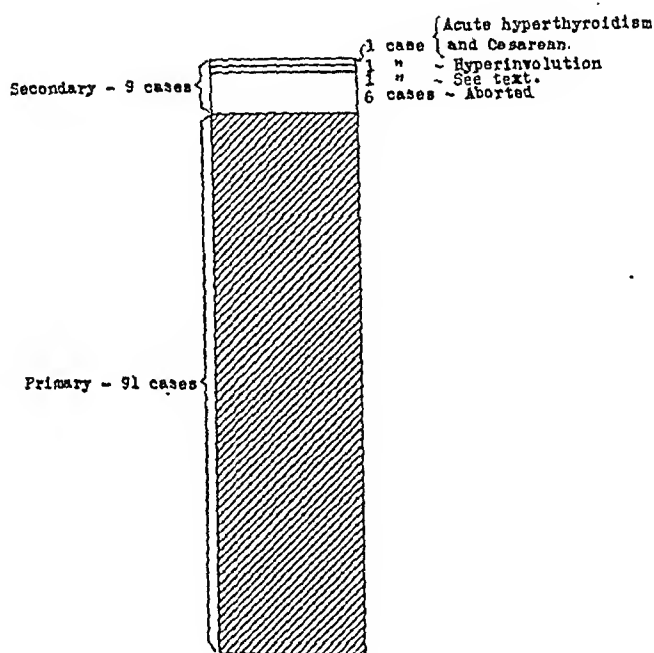


Fig. 2.—Fertility history.

2 cases a diagnosis of Froehlich's syndrome was made. There were 20 entries under the immature type. Typical of the more pronounced type was one patient, aged twenty-seven years, who although she graduated from college four years previously had the mien of a freshman. There were a gracile body, flat breasts and a narrow pelvis, and although teeming with feminine artifices, she reported frigidity and long-continued dyspareunia. Pregnancy followed, however, when the pelvic abnormalities were corrected. Only two patients were classed as masculine. In these cases general physical manifestations of the condition were obvious. In addition, one patient had a double uterus and the other, with a clitoris extending 3 cm. from the symphysis, was doubtless an intersexual. Three women were classified under "stunted growth" for want of a more scientific heading. Many such cases are doubtless pituitary problems. One

brilliant girl in this group, however, had an upper spine deformity with some variation in the size of the hands and other symptoms which a neurologist attributed to a temporary hemiplegia in early infancy due to unknown injury. As her physical abnormalities were not inherited, her

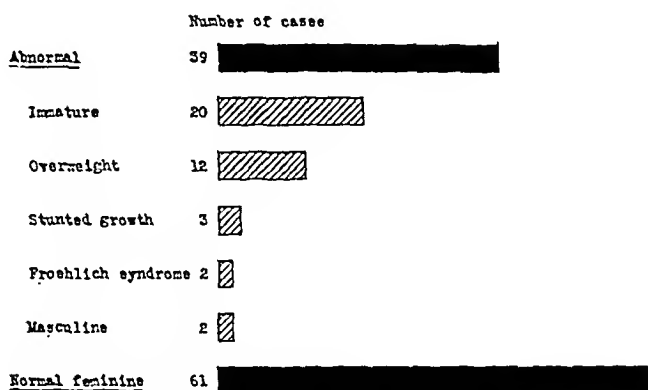


Fig. 3.—Physical types varying from normal feminine.

habitual amenorrhea, antelexion, and lateral uterine displacement (which corresponded to the early paralysis) were treated, pregnancy followed, a 5½-pound otherwise normal baby was delivered at term and is now thriving. The other patients of this group reported failure to grow after a definite time in adolescence, one attributing the condition to the shock

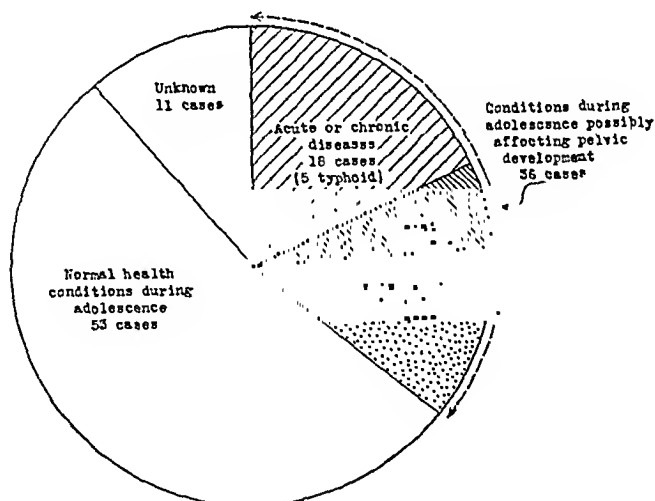


Fig. 4.—Abnormal conditions of early adolescence.

of her mother's death and the heavy responsibilities she assumed as the oldest child, while the other patient accepted the condition as a family trait. In the former case successful results were obtained but the latter who came at the age of thirty-two years, with marked hypoplasias, was less fortunate.

## HEALTH DURING ADOLESCENCE

The histories of certain intelligent patients have focused my attention upon the possible influence that disease (acute or chronic), major operations, hard work, and excessive athletics during early adolescence may bear to sexual drag or underdevelopment. The adolescent history relative to these factors has been secured in 89 cases (Fig. 4). Because the figures are possibly without value, unless compared with a normally fertile series, they are given without comment except to state that the percentage of typhoid (5.5 per cent) seems high and that in view of the retardation of skeletal growth and mental development which is known to occur in some instances of severe disease in adolescence such a history should be

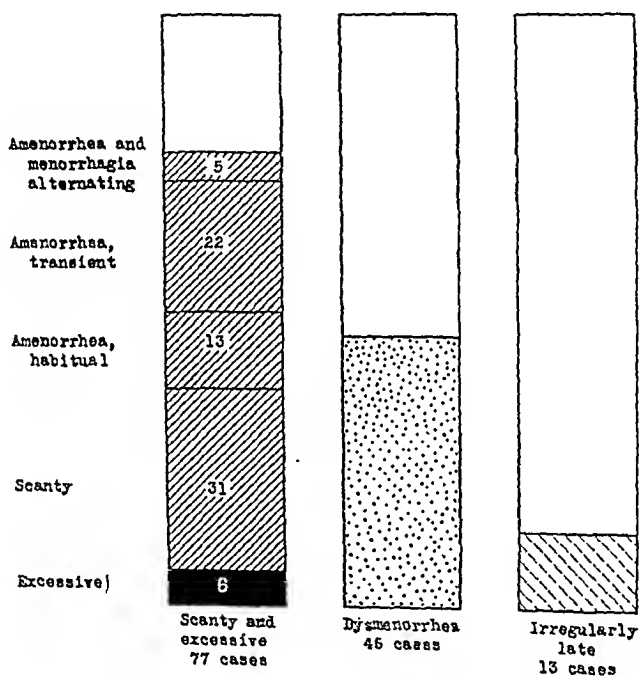


Fig. 5.—Summary of menstrual irregularities.

covered in all sterility problems. Experience with a few adolescent girls warrants a further study of the relation that excessive competitive athletics in girlhood bear to their pelvic development.

## MENSTRUAL IRREGULARITIES

Menstruation began in these 100 patients at an average age of 13.5 years (Fig. 5). The onset was as late as eighteen in three cases while in one, three and eleven patients it began at the seventeenth, sixteenth, and fifteenth year, respectively, totaling 18 per cent in whom menstruation was definitely delayed. In other respects Fig. 5 speaks for itself, and so much has recently appeared in the literature bearing upon this subject that further comment will not be undertaken. Dysmenorrhea is confirmed as

a very frequent symptom of underdevelopment and abnormal uterine rhythm. Menstrual deficiency far exceeds excessive flow as a functional disorder in sterility problems and the latter is found to be more difficult to manage. Amenorrhea is tabulated as transient when reported during adolescence only or at rare occasions thereafter, and as habitual when experienced frequently throughout sexual life. In at least two patients of the latter type pregnancy occurred during a period of functional amenorrhea. In one patient of the menorrhagia group, endometriosis was encountered, while in another patient, thirty-two years old, in whom menorrhagia alternated with amenorrhea, marked hyperplasia of the endometrium was found and the specimen was at first reported malignant but subsequently termed border-line and innocent by Dr. Ewing.

#### BASAL METABOLISM

Dysfunction of the thyroid may be associated with both oligomenorrhea and menorrhagia, and hypertrophy (with or without toxemia), pelvic hypoplasias, scanty periods and childlessness have been found coexistent in a few patients who are not included in this series because the sterility problem was not the major complaint. In 18 cases the clinical symptoms were sufficiently suspicious to suggest metabolism studies (Table I). The average group findings indicate little. Individual results showing 6 cases with abnormally deficient and 3 with abnormally high metabolism records,

TABLE I. METABOLISM FINDINGS IN 18 CASES

Minus	11 cases	Average 10 % -	Maximum 27 %
Plus	7 cases	Average 13 % +	Maximum 27 %
Abnormally high 3			
Abnormally reduced 6			

with one success in the former and 2 in the latter group, did little to dissipate my perplexity as to what direct relation, if any, the thyroid bears to infertility. These patients received a trial of medical treatment, gynecologic procedures having been concomitant or deferred as indicated by the correlation of all potential factors. The maximum and minimum finding were each 27 per cent. My limited experience would seem to indicate that the clinical symptoms of the overacting and underacting thyroid are sometimes very similar and in such cases laboratory study may be helpful. It is only just to say that in an occasional case tested during the same week by two different laboratories, wide variations have been reported.

#### ANATOMICAL ABNORMALITIES

Probably the majority of gynecologists entertain some doubt as to whether structural abnormalities of the female reproductive tract com-

monly attributed to sexual drag actually have such an origin. Either a pro or con opinion is difficult to sustain, but a correlation of the items across the work-sheets seems to present affirmative evidence. Any one or any combination of the several lesions described may be encountered in the individual patient. Hypoplasia of the external genitalia is, of itself, probably of little significance in fertility, nor is it alone used as a basis for case selection, but in this series smallness of the vulva does seem to be frequently related to lack of emotional development. Shallowness of the vagina, annular constriction, shortening of the anterior wall and septa have

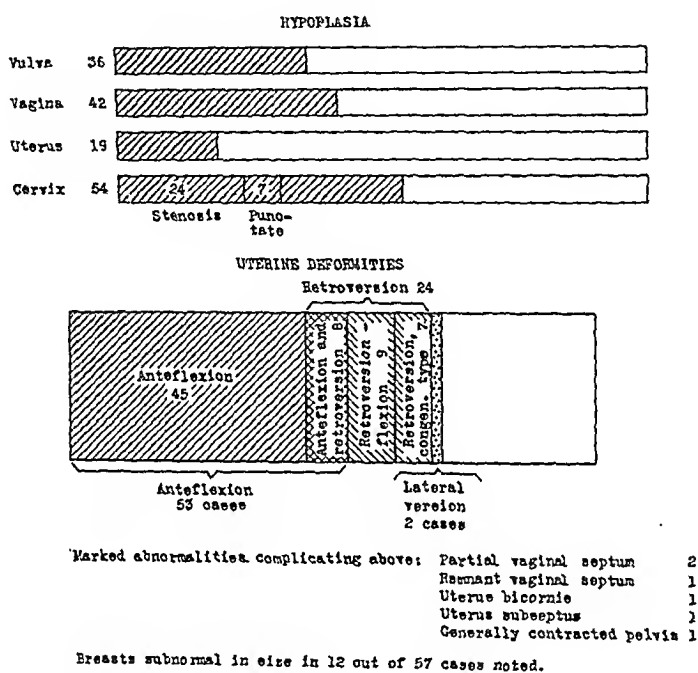


Fig. 6.—Summary of hypoplasias and structural deficiencies.

been included under vaginal underdevelopment. Experience causes me to place greater emphasis on cervical lesions as stigmas of underdevelopment and causes of low fertility than upon the lesser degrees of fundal hypoplasia. Under the "cervical group" the total number of these cases with stenosis and a punctiform external os has been noted. The slender conical cervix is also included under "hypoplasia," and when its length is markedly increased with corresponding hypoplasia of the fundus, the prognosis is less hopeful. The diagnosis of hypoplasia of the fundus was made with considerable hesitancy. In at least five instances, a reduction in uterine length ( $2\frac{1}{4}$  inches or under) was confirmed by sound and successful results occurred in three of these cases. Slenderness is the rule, but only when the size of the uterus is carefully palpated at different times in the menstrual cycle is an estimate possible, except in rare cases of infantilism. Uterine flexions and displacements were regarded as lesions of underdevelopment according to the indices accepted by most gynecolo-

gists; that is, the association of these findings with shortening of the pelvic fascia and other evidences of deferred or incomplete sexual development (Fig. 6).

The diagnosis of uterus subseptus is open to question, but it represented my best impression gained during digital removal of retained secundines after miscarriage. Pregnancy occurred after months of general building-up of this malnourished, socially ambitious woman who gave the history, already mentioned, of three generations of amenorrhea and one-child sterility. The bicornate uterus was revealed by instillation and x-ray.

The growth of the breasts is generally regarded as a secondary sex characteristic, but beyond recording the percentage of cases in which flat or small breasts were noted, no further statement will be made at this time.

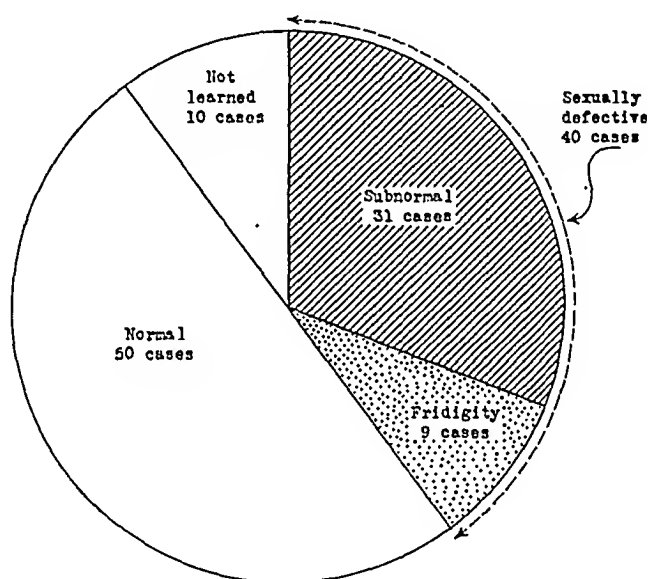


Fig. 7.—Approximate tabulation of sexual histories.

Vicarious bleeding from the breasts occurred in one case with habitual amenorrhea and hypoplasia.

#### SEXUAL INTEREST

The motives which may determine one's selection of a mate are so variable, and the fears, fixations, and inhibitions of both conscious and subconscious origin which may affect sexual response, are so numerous, that I suspect that a patient even with sincere intent and analytical guidance, is frequently unable to appraise her sexual reactions or potentialities. Fig. 7 represents my best effort of evaluation within the further limitations imposed by gynecologic practice. Patients who report a persistent indifference to normal emotions of coitus in which male responsibility seems to be eliminated are classified as frigid. The 10 per cent of frigidity in this very small series closely coincides with the percentage reported by Dickin-

son and Beam in "A Thousand Marriages." This would seem to signify that frigidity is no more common in the selected cases of this study than in a heterogeneous group. Under the "subnormal heading" have been included cases in which the transference of the erogenous zone has not occurred, those in whom sexual abstinence may be definitely sustained with equanimity and patients who without extrinsic explanation rarely experience an orgasm.

#### CONCOMITANT FACTORS

The concomitant factors involved in failure of fertility in this group study are itemized on the work-sheets but will not be discussed at this time. Such a tabulation would be of interest chiefly in an analysis of the

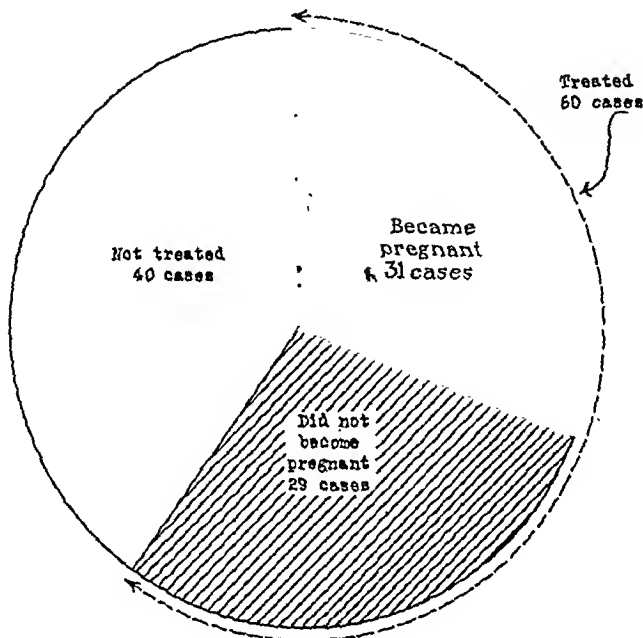


Fig. 8.—Record of treatment.

failures, a study now under consideration. In many cases, as will appear below, these coincident lesions assumed the major rôle in etiology and in determining management and in several instances contraindicated gynecologic treatment.

#### UNTREATED CASES

In 40 cases of this series (Fig. 8 and Table II) sterility was not treated by me for reasons which are sufficiently explained in Table II as to need but little further elaboration. Treatment was not undertaken in 14 problems, owing to conditions in the male. Complete absence of sperm cells in two specimen examinations was found in 8 cases. In 5 additional cases in which marked semen deficiency was revealed, the husbands, with or without urologic consultation, declined to follow recommendations. Impotence in the form of habitual premature ejaculation was discovered in one pa-



tient, and the unsophisticated wife had been subjected to much useless treatment on the misleading evidence of a condom specimen.

Among the untreated group of cases due to conditions in the female were 4 patients in whom the tubes seemed to be occluded. More than half of the patients with normal tube patency had received one or more patency tests before consulting me, as many as six insufflations being reported by one patient. Strangely enough, many of these patients were still ignorant as to the results of the tests or as to the pressure at which patency

TABLE II. REASONS FOR NOT TREATING 40 CASES

Condition of the male		14 cases
Azoospermia	8	
Highly deficient male	5	
Male impotence	1	
Condition of the female		7 cases
Occluded tubes	4	
Acute gonorrhea	1	
Tuberculosis	1	
Hyperthyroidism	1	
Other reasons		19 cases
Declined treatment	10	
Consultation cases	9	

was effected, and many of them submitted to a repetition of the procedure thinking it was of major therapeutic value. These women might have been saved the risk and traumatism of repeated tube tests if the first investigator had submitted an intelligent statement to the patient.

Investigation was contraindicated in one patient owing to evidence of active gonorrhea, and the risk of motherhood seemed sufficient in one patient with tuberculosis, and in another with marked hyperthyroidism to justify the omission of treatment.

Fear, economical stringency and reluctant cooperation caused treatment to be declined, deferred or transferred to another physician in ten instances, while 9 other patients came or were referred for diagnostic study only.

#### TREATMENT AND RESULTS

Tabulating cases under any one form of treatment is extremely difficult for tonic, dietary (Vitamin), hygienic, and specific forms of medical treatment were frequently carried out in conjunction with local procedures, and in not a few cases, the husband and wife were under treatment simultaneously. I have attempted to classify my cases under what seems the most important gynecologic procedure (Tables III and IV). As the basis of group selection and study was gynecologic, the treatment of the husband is entered as supplementary and was carried out in 10 cases, in some of which it may have possibly constituted the most important item. As

glandular therapy was not continued as the sole method of treatment in any successful case, it is also tabulated as supplementary in 13 instances and its curative value in relieving sterility was not impressive. Under the "Supplementary" heading might have been included two cases with obvious ovarian deficiency, in which, after all other methods had failed, a trial of x-ray stimulation was accepted by the patients after receiving a frank statement of its uncertainties. Results were disappointing but it is only fair to state that the uterus was markedly hypoplastic in one case, and

TABLE III. MAJOR GYNECOLOGIC PROCEDURES WITH RESULTS IN 60 CASES

CHIEF TREATMENT	CASES TREATED	PREGNANT
General: Diet, tonic, etc.	7	2
Local	2	-
Dilatation and curettage	6	3
Dilatation and curettage and radium*	2	-
Dilatation and stem	15	9
Dilatation (office)	5	4
Dilatation and cautery	2	1
Relief cervical viscosity	4	2
Longer wait	7	6
Pessary	7	2
Stem (office)	1	1
Premarital dilatation and excision of vaginal septum†	1	1
Salpingostomy	1	-
	60	31
SUPPLEMENTARY TREATMENT		
Endocrine	13	
Improvement male specimen	10	
X-ray stimulation	2	

\*One very early malignancy and one approaching borderline malignancy.

†Preceded by trial marriage.

a subnormal male specimen resisted all efforts of improvement in the other problem. Injection of this specimen, after x-ray treatment of the wife, was accepted by the patient and constituted the final effort to date. One unsuccessful dilatation and stem case was subsequently reported pregnant after x-ray stimulation under the care of another physician.

In recording the results of treatment the reporter has attempted to "lean backwards" in accuracy and honesty. I have charged myself with all cases in which treatment was instituted, accepting full responsibility if the male diagnosis was inaccurate or his improvement disappointing. Some patients are included as failures for whom the possibilities of successful treatment are not exhausted. Two cases have been entered as failures in which the necessity of radium administration after curetting rendered success practically hopeless, in fact, undesirable. In one of these patients, thirty-four years old, an extremely early, symptomless, and

therefore unexpected carcinoma of the fundus was discovered. Curettage was not planned in this case of hyperinvolution and stenosis until the routine procedure of clamp biopsy of the endometrium brought away a suspicious section. In the second case, already referred to, hyperplasia had advanced to a suspicious degree.

TABLE IV. ABSOLUTE AND CORRECTED PERCENTAGES OF SUCCESS

Based on total cases seen	31.0%
Deducting consultation cases and patients who declined treatment or were advised against the risk of motherhood	39.7%
Deducting also hopeless male deficiency or untreated semen abnormalities	48.4%
Deducting also cases of closed tubes	51.7%

On the other hand, cases of known miscarriage have not been subtracted, the reporter feeling that this is no more evidence of failure of sterility treatment than the loss of a fetus at a more advanced date owing to placenta previa or other obstetric accidents. Six couples who, after preliminary study and general instructions, were advised to defer specific treatment, and the wives subsequently reported pregnant, are credited as successes, this constituting in my opinion the most efficient type of service. Such cases finally requiring treatment were of course otherwise classified and the one who disappeared from care was included as a failure.

*Dilatation and Stem.*—The largest number of cases (15) is entered under the heading of "Dilatation and Stem Pessary." The solid glass Baldwin stem was used in all cases, being left in situ, unless disturbing, from four to seven weeks. The large number of successes (60 per cent) occurring in this small group of cases is attributed to great care in the selection of patients and special effort in technique involving the anchoring of the stem entirely within the external os by a deep, snug and inelastic suture. The loose suturing previously advocated has been abandoned because mobility with partial expulsion of the stem increases the drag upon the sutures. The stem is omitted when curettage is required. Any suspicion of past or present infection in the husband or wife is considered an absolute contraindication, and as a further prophylactic measure against infection, intercourse is interdicted while the stem is in place, mild antiseptic douches are ordered twice weekly and inspection is made at ten-day intervals. I am not unaware of the adverse criticism this method of treatment will evoke from many gynecologists. The controversial features will not be discussed beyond saying that objection to the intrauterine stem is often based on negative theoretical grounds or results from improper choice of stem, or selection of patients. Many gynecologists of highest repute and

widest experience are warm advocates of its use in certain cases of sterility and dysmenorrhea although the *modus operandi* by which results are obtained may not be definitely understood. Observance of a clinical phenomenon often precedes the explanatory formula. Suffice it to say that in addition to the purely mechanical factors which it may correct there are some evidences, by animal experimentation, that a reflex stimulation may occur. Parkes<sup>3</sup> states that mechanical irritation of the cervix stimulates the ovary and quotes the work of Long and Evans<sup>4</sup> indicating that this effect is exerted indirectly through the anterior pituitary and Corner has demonstrated that under certain conditions of glandular activity any foreign body in the uterus causes decidual growth. The patient entered under "Office Stem Treatment" was twenty-seven years old and had sustained hyperinvolution of the uterus ( $2\frac{1}{4}$  inch cavity) following her first delivery three years before. She had almost given up hope of becoming pregnant, consulting me principally for an amenorrhea of two years' standing with weight gain and other symptoms of early menopause. After stimulating a uterine flow of three days' duration, the stem was temporarily replaced at four-week intervals over a period of four months, with fairly regular uterine bleeding. The stem was then discontinued and endocrine treatment, which the patient had taken unsuccessfully for the previous year, was again prescribed and a successful pregnancy began two months subsequent. One of the successful cases entered under the "Dilatation and Stem" group was subjected to laparotomy for retroversion at the time the stem was inserted, contrary to my usual procedure. Radical intervention was requested because the patient planned to soon leave for the Far East where further study and pessary control would be impracticable. Laparotomy has been avoided whenever possible. Invasion of the peritoneal cavity occurred in but two other cases. In one of these, salpingostomy is entered as the major procedure. This patient with cervical stenosis and a hypoplastic anteфлекed uterus was also found to have occluded tubes attributed to acute appendicitis and operation soon after marriage. Right oophorectomy was also reported but owing to the death of the surgeon and the absence of data in a general hospital of a large city no confirmation was obtainable. Against advice and the most discouraging prognosis the patient urged operative interference at which time it was discovered that the left tube had also been sacrificed and the right tube damaged.

*Vaginal Pessary.*—In 7 cases the use of the vaginal pessary was deemed the major gynecologic procedure. The important indications for the pessary are a shortening of the vagina with a marked anterior displacement of the cervix, associated with retroversion-flexion, providing careful post-coital study indicates prompt semen loss and deficient spermigration. The depth of the vagina may be definitely increased by this method of treatment as demonstrated by the necessity for larger pessaries as the case

progresses. Women frequently report a prompt modification of their sexual experience. In 2 cases of this series in which occlusion of the tubes was also encountered, normal patency was found, not immediately but two months subsequent to reposition and support of the uterus. This result is attributed to the subsidence of a coexisting edema, a possibility that should be entertained in cases of unexplained tubal obstruction complicating replaceable retroversion.

If the retroversion resists efforts of reposition made with the patient under anesthetic or after trials of replacement at the office with the patient in the knee-chest and tenaculum traction on the cervix, the problem assumes of course a much more formidable character.

*Other Factors.*—The 4 successful cases tabulated under "Office Dilatation" were patients in whom pregnancy occurred so promptly after completion of the diagnostic routine that the result seemed attributable to anatomical or secretory changes in the cervix following the passage of a sound, suction or insufflation cannula, etc. It is possible that pregnancy may have occurred incidental to the study; a small margin of error that must be accepted in most statistical studies. Patients whose blood examinations showed anemia and were obviously undernourished or nervously exhausted have received appropriate medical treatment. Statistics from tubercular colonies and observers in busy obstetric services will suggest that attention to these details may be a contributing but certainly not an essential factor in increasing fertility. The diet of patients has been scrutinized but not to the point of calorie tables. The greater percentage of these patients were highly intelligent women with considerable knowledge in selecting well-balanced menus for the family. In a few instances a nitrogenous intake was increased. Cod liver oil or other dietary increases favoring weight gain were often declined by patients unless they were definitely malnourished. I admit a lack of knowledge and experience in the use of vitamins. Because Vitamin E is largely omitted from one's diet and seems theoretically indicated an investigation is now being made as to the practicability of a concentrate.

In conclusion, it may be stated that these cases have been managed first, and most important, by meticulous diagnostic study to appraise in the individual case the significance of functional deficiencies and the rôle played by developmental defects in the prevention of fertility; and, secondly, by the correction of causative factors according to sound principles of medical practice and well-established gynecologic procedures, methods which may be improved or superseded tomorrow by the discoveries of our biochemists.

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# OVARIAN STRUMA: A MORPHOLOGIC, PHARMACOLOGIC, AND BIOLOGIC EXAMINATION\*

ALFRED PLAUT, M.D., NEW YORK CITY, N. Y.

(From the Beth Israel Hospital)

SINCE at the beginning of this century, Ludwig Pick<sup>1</sup> insisted upon the thyroid character of ovarian struma, the term "ovarian struma" designates a definite type of ovarian tumor. Ovarian struma is a teratomatous ovarian tumor in which large amounts of typical thyroid tissue are present. The term therefore does not apply to the small areas of thyroid tissue which are found in about one-third of all dermoid cysts.

About 70 case reports of ovarian struma exist in European and American literature.<sup>2, 3</sup> Our purpose is not to increase the number of the case reports, but rather to settle a long-standing dispute. Many have stated that a tumor may resemble thyroid tissue very closely and nevertheless it may not be thyroid tissue functionally. Such a question concerning most organs cannot be answered. In the case of the thyroid gland, however, we fortunately have chemical, pharmacologic and biologic methods to prove the thyroid character of a given tissue. To anticipate our result, we can say that thyroid tissue in ovarian struma chemically, pharmacologically and biologically behaves like thyroid tissue.

The three cases we had the opportunity of examining were briefly the following.

CASE 1.—Scotch housewife, forty-seven years old, married twenty-four years, one adult child, one abortion three years ago. Menopause began a year before admission to the Woman's Hospital.

She came to the hospital because for five months she had a pain in the left side of the abdomen. A mass could be felt in the left side. The provisional diagnosis rested between ovarian tumor and endometriosis.

At operation an ovarian tumor the size of an orange was found behind the uterus to the left. Uterus and right appendages were normal. The tumor was apparently cystic but heavy. One portion of the surface was suggestive of endometriosis. The pathologist, on gross examination in the operating room, declared the tumor malignant. Therefore the body of uterus and the right appendages were removed. The cervical stump received some prophylactic radiation afterwards. The patient was well three years after operation.

CASE 2.—Roumanian housewife, thirty-five years old. She has two living children. Twelve years before admission to Beth Israel Hospital, a mass in the abdomen was noticed and the patient was advised by the doctor to have it removed. The mass grew larger gradually, not showing any changes during the pregnancies. Every summer the patient had vomiting spells with considerable nausea. This condition became worse and caused the patient to ask for operation.

At operation a large, multilocular cyst of the left ovary was found. There also was a large, cystic mass in the right ovary, the uterus was slightly enlarged but normal in appearance. The upper part of the body of uterus and both appendages were removed. This patient was in good health two and a half years after operation.

\*Presented by invitation before the New York Obstetrical Society, May 10, 1932.

CASE 3.—Russian housewife, fifty-five years old. She has seven living children. She entered into menopause five years ago. Her abdomen had always been large, but it became much larger in the weeks before admission (to Beth Moses Hospital\*). She had frequency of urination and mild, indefinite pains. On physical examination the



Fig. 1.—Case 3. Gross specimen of ovarian struma. The photograph was taken from a museum specimen after some shrinking had taken place. The dark central portion consists of thyroid tissue with compact bone. The whole specimen, even the wall of the large uncharacteristic cysts, is thyroid tissue also.

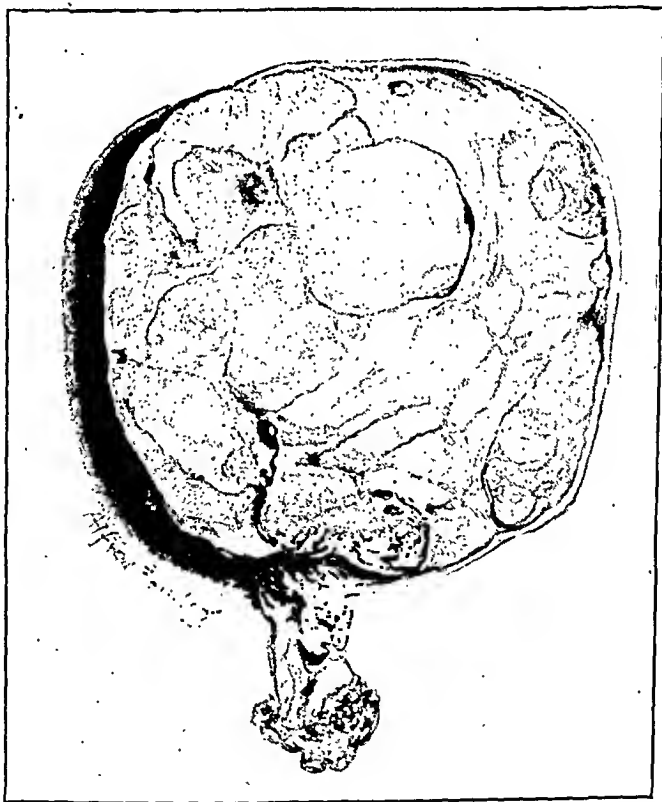


Fig. 2.—Case 1. Ovarian struma. Gross specimen. Photograph taken from a water-color. The area which is the shape of a figure-of-eight near the attachment of the ligament, is typical thyroid tissue and has a very high iodine content. The glistening round masses are mucin; the remainder is solid tumor.

\*This specimen was given to me by the late Dr. Kwartin.

abdomen was found full of ascites. At the same time a large, soft, movable, not tender mass was found. The clinical diagnosis was ovarian cyst.

At operation a right-sided ovarian cyst was found, together with a large amount of ascitic fluid. No follow-up notes on this patient are available.

#### MORPHOLOGY

All three specimens have the character of ovarian teratoma. They contain different tissues, as for instance, bone, nervous tissue, mucinous



Fig. 3.—Case 1. Nervous tissue in ovarian struma. The thyroid character is evident. Thyroid goiters do not contain nerves. The presence of the nervous tissue indicates the teratomatous character of ovarian struma.

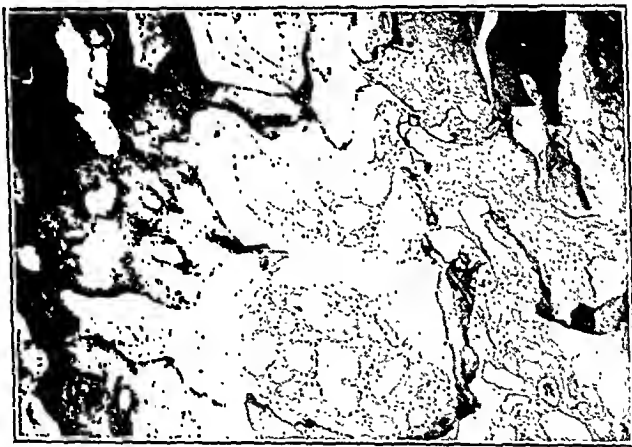


Fig. 4.—Case 3. Dense bone with typical thyroid tissue in the marrow spaces. The bone is a sign of the teratoid character.

glands. In all three specimens pseudomucin was absent, and there were no histologic signs of ovarian cystoma. Cystomas are very frequent in the ovary and very often found together with dermoid cysts. It therefore is not astonishing to find a cystoma and a teratoma, as for instance the ovarian struma, in the same ovary. This is coincidence.

The gross specimens will not be described in detail since such descriptions are abundant in the literature. In the second and third cases almost the entire tumor consisted of thyroid tissue. This is often the case in large



specimens (Fig. 1). It is assumed that the thyroid tissue for some unknown reason has grown and has destroyed the other tissues by pressure. In the first case there was an unusual feature about the gross specimen; namely, large, gray, solid areas, and large mucinous (not pseudo-mucinous) areas (Fig. 2).

In the microscopic description also we do not intend to repeat the statements of other authors, but we want to dwell on unusual features only. Aside from the ordinary structure of colloid goiter, histologic pictures were encountered which are found in the thyroid gland, some of them frequently, some rarely. Papillary portions are often seen in goiter, and epithelial bolsters with high cylindrical cells. We are accustomed to seeing nerves in the teratoid dermoid cysts of the ovary, but it is a striking

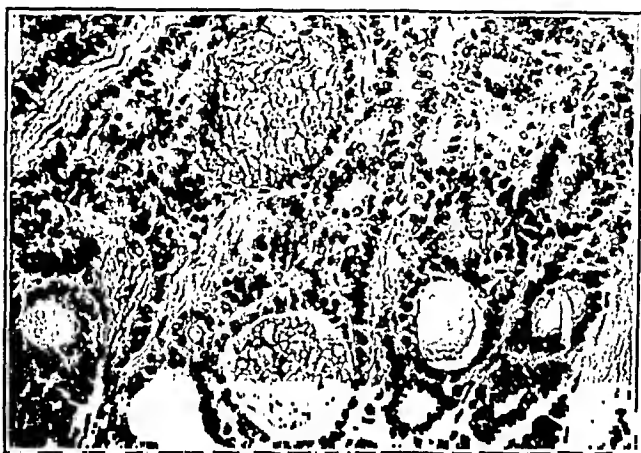


Fig. 5.—Case 1. Mucicarmin stain. Ovarian struma. Several follicles are filled with thyroid colloid. It appears homogeneous. One large follicle is entirely filled with mucin. It appears darker and filamentous. The medium large follicle at the edge of the picture is mostly filled with mucin, but its outer portions are occupied by thyroid colloid. This definitely proves that the mucin is produced by the thyroid adenoma itself.

picture to see thick nerves in a goiter nodule, as they were found in two of our specimens (Fig. 3). The same applies to the bone tissue so often encountered in dermoid cysts of the ovary. In our third specimen the thyroid tissue is growing in the spaces of very dense bone, filling them in the fashion of bone marrow (Fig. 4).

The production of mucin deserves special consideration. In our first specimen mucinous glands were found. This is nothing unusual. The upper respiratory tract very often is represented in dermoid cysts, and mucinous glands similar to those of the trachea are frequently found. Large masses of true mucin, however, do not belong to the picture of a dermoid cyst of ovary. The mucus found in our first specimen probably does not come from the occasional mucinous glands. It is a product of the solid tumor which is found together with the thyroid tissue. We talk about true mucin only when the histochemical reaction for mucin has been definitely positive (mucicarmin stain). Astonishingly enough, mucin was found in typical thyroid follicles, and typical thyroid secretion was

found together with true mucin within the same follicle (Fig. 5). In the operative material of New York City, mucin in a goiter is something unheard of. In goiter countries like Switzerland, for instance, mucinous change has been found in congenital goiters.<sup>4</sup>

The thyroid tissue, the mucus producing portions, and carcinoma-like solid tumor were found side by side and even intimately mixed (Fig. 6).

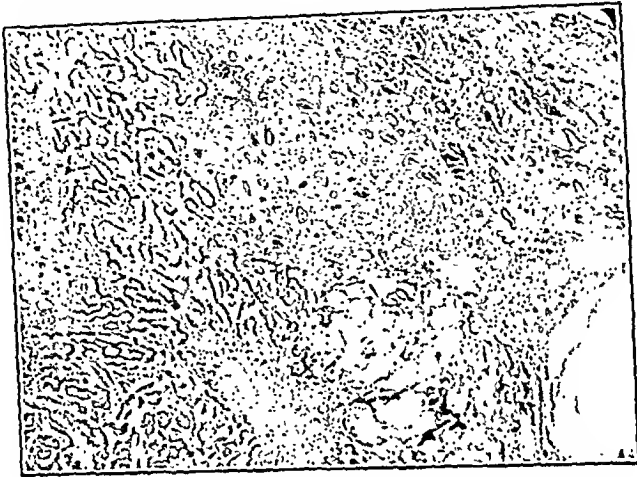


Fig. 6.—Case 1. Thyroid tissue mucin (the white area), and trabecular carcinoma are intimately mixed in the tumor.



Fig. 7.—Case 1. Higher magnification of the solid tumor. Trabecular and tubular growth.

The character of the solid malignant tumor again points in the direction of young thyroid tissue. It resembles the tubular and trabecular struma of Masson,<sup>5</sup> which is found in young people chiefly (Fig. 7). The similarity of the tumor in our Case 1 with the pictures of trabecular adenoma of thyroid is striking.

From the foregoing it is evident that ovarian struma, not only in the common features, but even in unusual ones, morphologically behaves like true thyroid tissue.

## CHEMISTRY

The thyroid gland differs from all other organs by its high iodine content. The iodine figures of analyses of thyroid vary. Nevertheless the order of magnitude always is different from the figures for the iodine content of any other organ. This applies as well to malignant tumors, which, under certain conditions, may store iodine given by mouth.

The literature contains few reports on the iodine content of ovarian struma. Robert Meyer<sup>4</sup> in 1903 found 0.014 mg. of iodine per gram of dried ovarian struma. Neu<sup>7</sup>

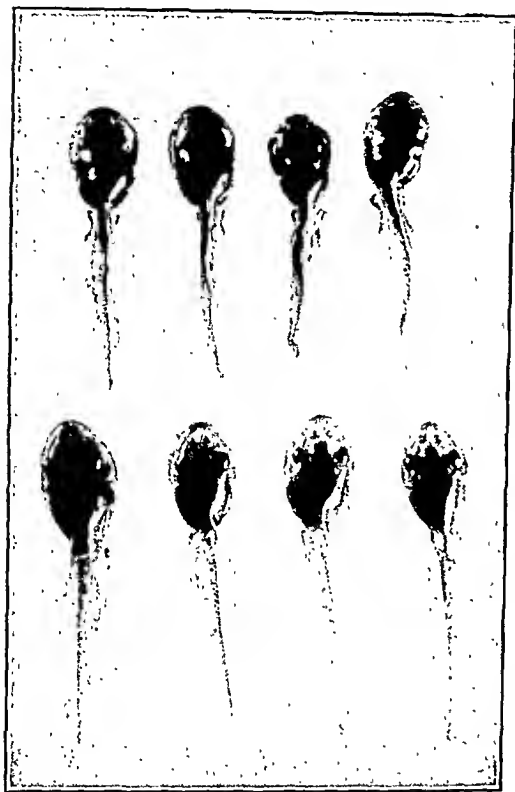


Fig. 8.



Fig. 9.

Fig. 8.—Tadpoles fed with material from Case 2. Upper row, four tadpoles fed with ovarian struma which contained iodine. The animals have well developed hind legs, their body and head begin to be frog-like. Their tails are thin. Lower row, four control animals from the same egg ball. They have only small buds in place of the hind legs. Their tails are large and broad, their body and head are regular in shape.

Fig. 9.—One tadpole fed with ovarian struma from Case 2, together with one control.

in 1911 found 0.02 mg. Schauta<sup>8</sup> in the same year reported positive iodine findings without giving figures. There are a number of negative iodine findings. The authors have expressed different opinions as to the meaning of positive or negative iodine findings.

Our three specimens have been examined for iodine according to the method of Kendall and Richardson<sup>9</sup> by our chemist, Dr. Ella H. Fishberg. All analyses were done repeatedly and with controls. The thyroid-like portion of Specimen I contains more iodine than any ovarian struma ever examined. The figure of 0.673 mg. of iodine is in the order of magnitude

of thyroid and not of any other organ. The malignant portions of the same specimen contain a very small amount of iodine only. The second specimen contained 0.025 mg. of iodine, which is still above the range of any other organ. In the third specimen, on repeated analysis, no iodine could be found. As shown in Chart 1, fluid from the ovarian cysts, and malignant tumors of breast as well as of ovary were examined with the same technic, and were found free or nearly free of iodine.

Thus the chemical examination proves the thyroid character of ovarian struma.

TABLE I. THE IODINE CONTENT OF OVARIAN STRUMA COMPARED WITH THAT OF OTHER TUMORS AND ORGANS

	MG. OF IODINE PER 100 GM. OF DRY SUBSTANCE
Normal thyroid	1.8
Normal thyroid	2.3
Case 1. Thyroid-like portion	0.673
Case 1. Carcinoma-like portion	0.004
Case 2. Struma ovarii	0.025
Case 2. Cyst fluid from other ovary	0
Case 3. Struma ovarii	0
Cancer of breast	0
Cancer of ovary	0.004

#### PHARMACOLOGY

Reid Hunt<sup>10</sup> has discovered a pharmacologic test for thyroid. He found that the feeding of thyroid under certain precautions protects mice from acetonitril poisoning, while it makes rats more susceptible. The astonishing fact that the two closely related animals behave in an opposite way renders this test especially accurate. The test is carried out in the following way. Young rats which have been kept on a constant diet are fed with the substance which is to be examined for its thyroid action. After a certain time an injection of acetonitril is given in different dosages, and the lethal dose is determined. The lethal dose for untreated animals must be determined in a large number of rats or mice beforehand.

It is unknown why thyroid feeding has this effect upon the splitting of the acetonitril molecule. Acetonitril poisons by giving off hydrocyanic acid. The technical details of the animal experiments have been described elsewhere.<sup>11</sup> The material from Case 1, with the very high iodine content, had all been used up for microscopic and chemical examination. The positive results obtained in the acetonitril tests thus represent minimum figures. We should have expected still more striking results if we had had the material with the highest iodine content available for feeding. Material from Case 2 fed to mice in different series of experiments with controls for every single series protected the mice from the acetonitril poisoning to a considerable degree, as shown in Fig. 10. Correspondingly, the rats fed with the same material succumbed to a lower dose of acetonitril than the untreated control animals (Fig. 11). The tumor material from

the first specimen, which had a very low iodine content, showed only a very slight thyroid effect in the acetonitril tests. The iodine-free material from Case 3 had no effect.

These experiments show that ovarian struma has the pharmacologic effect of thyroid in proportion to its iodine content.

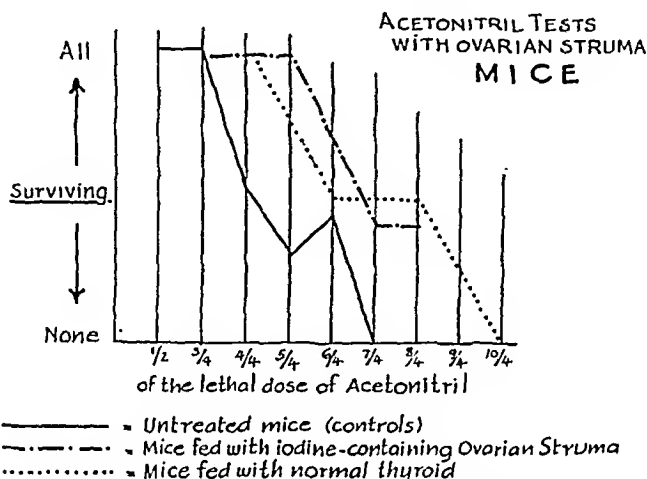


Fig. 10.—All of the mice fed with the iodine-containing ovarian struma survived a full dose (4/4). More than half of them survived  $1\frac{1}{2}$  times the dose (6/4). Some survived even the double doses (8/4). The curve for the mice fed with the ovarian struma and the curve for the mice fed with the normal thyroid are to the right of and above the curve for the control animals.

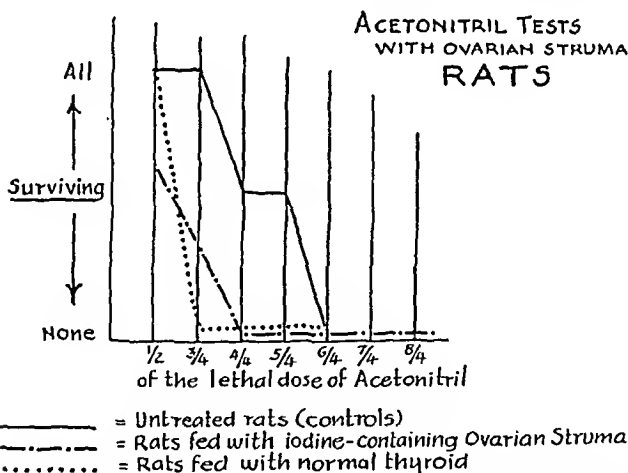


Fig. 11.—None of the rats fed with the ovarian struma survived a full dose (4/4). Even after  $\frac{3}{4}$  of the dose, only a minority survived. The curves for the rats fed with ovarian struma and the rats fed with the normal thyroid are to the left of and below the curve for the control animals.

#### BIOLOGY

Gudernatsch<sup>12</sup> in 1909 found that tadpoles rapidly develop into miniature frogs when they are fed thyroid. He and his coworkers in innumerable, painstaking experiments have determined the tadpole effect of the different organs and of many chemical substances. Thus, thymus feeding, for instance, makes tadpoles large but prevents, or at least retards, metamorphosis, while other organs, like liver and muscle, are indifferent. But

thyroid feeding stands out as the only feeding which can hasten the metamorphosis of the tadpoles considerably. Since there are biologic variations in the development of larvae like tadpoles, many control experiments are necessary if one wants to have reliable results. In our tadpole experiments also unfortunately we did not have the material from Case 1 with the highest iodine content available, but the results with the material from the second case are striking enough. Many of the tadpoles used for the experiments were photographed in order to have permanent records. Figure 8 shows four tadpoles fed with dried material from Case 2 together with four control animals from the same egg ball. The control animals received potassium iodide in their food corresponding to the amount of iodine which the other animals received in the ovarian struma they were eating. The animals fed with ovarian struma (upper row of Fig. 8) are smaller than the others; they have distinct hind legs; their tails are smaller. The shape of head and body in some of them is already frog-like. The material from the solid portions of Case 1, which contained very little iodine, and the material from Case 3, which contained no iodine, gave negative results in the tadpole tests. Control experiments with carcinoma of ovary were negative.

These tests prove that biologically also, ovarian struma must be considered true thyroid tissue. In conclusion therefore we may assume that ovarian struma morphologically, chemically, pharmacologically, and biologically is true thyroid tissue.

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#### ABSTRACT OF DISCUSSION

DR. ROBERT T. FRANK.—Dr. Plaut is to be congratulated on having found three struma ovarii out of the 70 which have been reported in the literature, and likewise for having given the final proof by his pharmacologic work to the statement that Pick made that these were true thyroid tumors.

These tumors are also of interest from a clinical point of view. I have had the opportunity of seeing two, the first one in which an ovarian tumor showed this honey-combed appearance with golden-yellow content forming practically the entire tumor with the exception of a small narrow piece of bone to which a tooth was attached. No other struma structures were found. The second patient was operated upon fifteen years ago. A large portion of the tumor appeared to be carcinomatous and yet the patient has remained well. In the literature, as far as I know, there has only been one case in which metastasis occurred. Therefore the carcinomatous portion of such a thyroid struma need not be considered unduly disquieting to the clinician.

Another point of interest is the fact that in many of these cases ascites is found and, therefore, when ascites is present and when the pathologist reports "carcinomatous areas," the clinician is naturally much worried, but I feel that he should be reassured.

DR. G. L. MOENCH.—I have seen three of these cases. We tested for iodine in all of them, but could not obtain even a trace. One of them was a serous cyst and two of them were dermoids; that is, to a small extent. The last one was particularly interesting because in this patient there were symptoms pointing to hyperthyroidism, but we did not evaluate them properly, because with an ovarian cyst ordinarily you do not think of a thyroid tumor. She had tremor, irregular heart action, palpitation, and the blood pressure was higher before than afterwards.

DR. S. H. GEIST.—Apropos of the case that Dr. Moench just mentioned, there is the well-known case in Frank's book in which the patient was operated upon for what turned out to be a struma ovarii. She had the classical hyperthyroid symptoms and following operation the patient was well. I believe, in spite of the report of but 70 cases of struma ovarii in the literature, that the condition must be more frequent. As Dr. Plaut has said, in the teratomas, and often in what we call dermoids, small areas of thyroid tissue, or thyroid-like tissue, are very common. There is not any question that a great many of these adenomatous areas may simulate thyroid structure, and without such convincing proof as Dr. Plaut has adduced one could not be sure that they are thyroid tissue. Nevertheless, morphologically they present all the evidences of thyroid. There is not any reason why there should not be thyroid in dermoids or teratomas, and there is not any reason why they should not undergo carcinomatous degeneration. We know in teratoma there are commonly carcinomatous areas. In the follow-up in most of the cases of struma ovarii in the literature, it has been found that the patients remain well after what seems to be malignant degeneration. That does not follow in teratoma in which true malignancy in the intestinal or respiratory tract takes place with a great tendency to recur.

DR. PLAUT (closing).—I do not know if Kovacs' case is identical with the one mentioned in the literature, where seven years after operation for ovarian struma abdominal carcinoma was found. Despite the many reports on the benign character of ovarian struma, I think it would be well to watch these patients carefully for longer than the usual five year period.

The reports of the two patients in which symptoms of hyperthyroidism disappeared after extirpation of ovarian struma are very interesting. Unfortunately, there is one report about symptoms of hyperthyroidism appearing after removal of an ovarian struma. Thus, we must be careful in our interpretation of clinical signs no matter how suggestive they may be.

Dr. Moench referred to a case in which there was a serous cyst in the ovary, which leads to refer to another point of morphology. The ovarian struma has nothing to do with the cystadenoma, either the pseudomucinous or the serous type. We have talked about mucin in the ovarian struma, not about pseudomucin. The dermoid cyst of the ovary and the cystadenoma also have no direct relation to each other. They are often found combined, simply because they are both frequent diseases. Thus, in Dr. Moench's specimen there must have been an ovarian struma and a cystadenoma independent of each other.

I do not want to leave the impression with you that many specimens of ovarian struma contain carcinomatous elements; on the contrary, only a minority of them do, and most specimens histologically are benign. In the older literature you will find statements that ovarian struma is malignant. It is not.

In a large number of reports about ovarian struma, the bean shape or kidney shape of the tumor is mentioned. This cannot be accidental—it has been observed too often. This peculiar shape may be helpful in clinical diagnosis, notably when it is combined with ascites in a patient who does not give the impression of being a cancer patient. Therefore it might be possible occasionally to make a clinical diagnosis of ovarian struma. It would be very interesting to do a metabolic test on such a patient before operation and to repeat the test after the effects of the operation have subsided.

## THE USE OF FOLLICULIN IN INVOLUTIONAL STATES

ELMER L. SEYRINGHAUS, M.D., MADISON, WIS.

*(From the Department of Medicine and the Wisconsin General Hospital, University of Wisconsin)*

AS A RESULT of the production in commercial amounts of folliculin, the hormone from the graafian follicle, considerable numbers of women have been relieved of the discomforts and disabilities incident to the menopause. In previous reports the results obtained in the common vasomotor disturbances have been cited.<sup>1, 2</sup> The similarity of some menopausal syndromes to thyrotoxicosis has been described and the symptomatic relief with folliculin has been demonstrated.<sup>3</sup> It is the object of the present communication to report the success attained when similar treatment was given to a series of women who demonstrated chiefly the psychic and nervous phenomena that are commonly associated with the involutional state.

Manifestations of the climacteric are protean in type. The nervous system, central and peripheral, the vascular, glandular, digestive, and reproductive systems are frequently disturbed during this period. Consequently it might be thought that an attempt to relate all these disturbances to a single fundamental change in function would be futile. The problem is no more impossible than the now accepted unitary explanation of the many pathologic processes seen in the study of a series of diabetics. In neither case has a complete chemical or physiologic mechanism been even suggested to explain the problems. But in the case of both diabetes and the menopause it has been the preparation of fairly pure hormone materials of standardized potency which has made the unification of thinking possible. In using therapeutic results as evidence for the nature of disease caution is necessary. Hormones can be shown to have effects which are useful therapeutically even though there is no evidence that a deficiency of the hormone existed before treatment began. Nevertheless the results from the use of folliculin have been so gratifying in scope as well as in frequency of response that they suggest to the author a replacement therapy for graafian follicle deficiency.

No listing of all possible symptoms of the menopause will be made. It is of interest to note the frequency of a few of the commoner features. For this purpose a series of 32 case records is available. These have not been included in the previous studies mentioned. They were all examined by the author, and the inquiry as to symptoms as well as judgment about such matters is therefore fairly uniform. None of the patients included was psychotic to the extent that she had been considered for commitment to any psychiatric institution. A number were studied



as menopause cases in spite of the existence of some other complaint that led to hospitalization.

Half the group, 16, noted paresthesias such as tingling, pruritis, formication, or numbness of extremities. Insomnia was reported by 19 as a distressing factor, which had not been present previously, and for which there was no other evident cause. It seems especially characteristic of this insomnia that the woman will sleep well for the first few hours, and waken between 2 and 4 A.M., to fall asleep again only after a long period of sleeplessness. This feature is variable, of course, but the morning wakefulness is far more striking than the inability to fall asleep when first going to bed.

There were 17 cases in the group of 32 who gave definite histories of psychotic features which had developed during the period of disturbed menstrual rhythm. The complaints ranged from increased "nervousness" to the typical involutional picture including despondency, subjective inadequacy for the usual tasks and responsibilities, emotional lability, suspicious attitudes, and frequent contemplation of suicide. Of this group only two had consulted a psychiatrist. None had progressed to an intensity of symptoms which required institutional management. Usually the process had continued for a matter of weeks to months when the patients were first seen.

A case summary will serve to illustrate the problem as it is presented to the family physician.

Mrs. S. noted beginning irregularity of menses at the age of forty-three. Her family were very much concerned about her mental condition because of failing memory, continuous worrying, and despondency with suggestions of self-destruction. She was working as a telephone operator, and her changing mental attitude made it seem that she would have to stop the work which helped support the family. Inquiry showed that she noted vertigo, weakness, hot flashes, paresthesias, and was much troubled with insomnia which had not previously been a problem. This woman was given small doses of folliculin by injection, and noted improvement at once. After two months it was found possible to discontinue the treatment entirely. Menses became regular again and no treatment was required for 12 months. A second attack was recognized promptly. Treatment was limited to theelol, 0.2 mg. or 100 units, twice daily, by mouth. Relief was complete within a few days and after four weeks the drug was omitted without return of the symptoms. There is reason to believe that she will again require assistance when the menopause once more begins to show symptoms.

In the therapeutic program the two items regularly used have been psychotherapy and the use of folliculin. The psychic approach hardly merits a name, for it has consisted simply of explaining to the patient the nature of her difficulty. The dependency of the mental picture on the physical change which she can recognize has been described briefly, and then the woman has been assured that this mental disturbance is temporary. Assurance is given that no permanent psychosis is to be expected. The similarity to marked fatigue has been suggested. The complaints of inadequacy for the usual tasks and responsibilities have been

ignored. Occasionally the patient has been told that the inability is purely subjective and temporary. It has not seemed necessary to assemble objective evidence or testimony of others that the woman is still doing her work well. This sense of inadequacy has become a minor matter when a rational attitude to the whole climacteric was secured. The morbid thinking about suicide is frequently not volunteered by the patient, of course, but when tendencies to despondency are mentioned a direct question about the matter of self-destruction has frequently elicited prompt admission of these thoughts. As a consequence of casual mention of this tendency in the resulting discussion, it is evident that great relief has been given the patient when she realizes that the suicidal problem is a part of this climacteric change. There has been no reason to suppose that casual approach to this feature has caused any resentment or started any morbid thinking when such thoughts had not been previously recognized by the patient. To experienced psychiatrists this matter of rationalizing the involutional state with the patient is nothing new. But it is distressing to realize that the general practitioners of medicine, young and old, are not aware of the desirability of such friendly approach to a problem that occurs chiefly in general practice. Even when hormone therapy is not used this psychic approach is available, and its value, not easily measured, is obvious when once tried.

It must be admitted that the success of the conversational method has been supported by the assurance of physical relief with the administration of folliculin. From the results here reported it would be difficult to decide just which symptoms are amenable to one and which to the other part of the therapeutic program. But in those cases where the use of the medication has been interrupted patients have quickly convinced themselves that the hot flashes, insomnia, paresthesias, and despondency are relieved by the folliculin, not by the doctor's words. Of the 17 patients with psychotic manifestations, the use of the follicular material has been carried out with 15 for a long enough time to see results. The results were distinctly questionable in two, but the other 13 showed undoubted improvement within a few days. Several of these have been followed for periods of 8 to 21 months to insure that results were being maintained so long as the treatment was continued regularly. Hot flashes and paresthesias are usually the first symptoms to disappear. Insomnia has been reduced almost as quickly. The patients have become cheerful again, been able even within a matter of a week or two to consider the former attitude with a smile, and in two cases have been able to resume occupation which members of the family were considering impossible due to the mental instability.

The most unsatisfactory cases to manage have been those women in whom it is evident that a long standing vasomotor and emotional instability has existed, since long before the menopause. Failure to secure complete relief from the various discomforts which such women com-

plain of is not surprising. Sometimes these patients have denied that any marked relief was obtained, but they have nevertheless continued to purchase the commercial folliculin preparation recommended even though expense was an important item. Continued use of hypodermic or vaginal suppository medication in spite of these disagreeable features may also be taken as evidence of subjective relief.

The age range of this group of cases is from thirty-two to fifty-six years. There are 10 cases aged forty-one or less, of whom special mention is required. Artificial menopause had occurred in 6 of this subgroup. One other was thought originally to be thyrotoxic, and her case resembles those reported previously.<sup>3</sup> The remaining 3 should apparently be considered as examples of hypofunction of the ovaries, rather than as menopause cases. No clinical criterion can be suggested for this differentiation, but the ages, (thirty-two, thirty-three, and forty) made the true climacteric questionable. Menstruation was irregular, regular, and absent, respectively, in these three patients. The symptomatic picture was so typically involutional that a therapeutic trial of folliculin was made and was followed by success of a surprising degree. In two patients regular menstruation has been reestablished. One of them prefers to believe that her difficulties can not be associated with the menopause but must be psychogenic in origin. But she returns to the use of folliculin repeatedly when she attempts to do without it.

The manufacturers of the different preparations of folliculin have advised the use of daily doses as high as 200 units. A not uncommon attitude has been to suppose that if a little helps, more would be still better. The author's experience leads to recommending an upper limit of about 40 units per day in the treatment of the menopause. The reasons are not so much the cost of the material, but the unfavorable action of larger doses. Overdosage has caused the reappearance of menses in one truly menopausal woman, has provoked menorrhagia and increased dysmenorrhea in an early menopausal patient, and a single dose of 50 units produced in still another woman a violent and persistent hot flash with great discomfort, although this was followed by freedom from such symptoms for two days. Conversation with clinicians who have failed to secure benefit from the folliculin treatment in cases with involutional psychosis has revealed the fact that very large doses were being employed. It is possible that the failure was due to the excessive dosage. Small doses seem worth considering also for the treatment of younger patients, since it appears that excessively large doses are apt to lead to ovarian atrophy. This may be brought about by the inhibitory action of the large doses of folliculin on the anterior pituitary function, with a secondary lack of pituitary stimulation to the ovaries. In view of these experiences and since there is no known method of estimating the required dosage in advance, the therapy in these cases has been carried out by the use of 10 to 25 units at one time, given once or twice daily. Theoretically the more

frequent small doses are undoubtedly better than larger and less frequent ones.<sup>4</sup>

The patients with artificial menopause have been the most difficult to free from symptoms by folliculin therapy. The difficulty has been met in part by the use of somewhat larger doses. Evidence for this more refractory nature of the symptoms in patients with an artificial menopause is the longer interval required after the beginning of treatment before there is evidence of improvement. Usually this interval does not exceed two days, but it has been as long as two weeks in the radiated or operated cases. Early failure or lack of result from small doses need not lead to abandonment of the treatment, but should call for persistent use of moderate doses.

The refractory nature of the artificial menopause is illustrated by the case of Mrs. H., aged thirty-six. Menstruation began at age fifteen, and was regular every twenty-eight days, duration five days. There are two children. For reasons unknown to us appendectomy done at age twenty-six was accompanied by removal of both ovaries and tubes. There has been no menstruation since, but the patient has complained of hot flashes, frequent attacks of irritability and weeping, weakness and vertigo, headaches, amblyopia, and scotomata. At age thirty-four an operation for adhesions was performed. Since then there have been palpitation, burning and gnawing epigastric pains not relieved by food, variable appetite with frequent nausea and vomiting. She complained of constipation but had mucous stools. She has recently been continually discouraged and despondent. Physical examination showed nothing unusual except a soft systolic murmur at the apex, disappearing on arising, blood pressure 122 systolic, 88 diastolic, general colonic tenderness, and a palpable thyroid isthmus. Laboratory data were of no significance. Relief from the digestive symptoms was partial following the use of bland diets and belladonna. Folliculin was administered in 10 unit doses (amniotin) twice daily for ten days. Relief from the numerous complaints was definite but far from complete. Change to use of 25 units once daily (theelin) gave slightly more relief. The patient insisted on discharge because of the cost of treatment. Report by mail subsequently showed that there had been practically a complete relapse at home, since she was unable to pay for the expensive medication. During the hospitalization omission of the medication for one day had allowed a return of frequent hot flashes and of depression. The refractoriness of this case is appreciated only by comparison with the prompt relief obtained in the case described above and in those previously reported.<sup>1, 2</sup>

Mrs. E., aged forty, had been diagnosed as suffering from cervical carcinoma (biopsy) and had radium implantations in June and August of 1928, followed by deep radiation in October and January. In January, 1929, acute symptoms led to appendectomy and hysterectomy in another hospital. She was treated for pyelitis and cystitis from July to November, 1929. In September of this year she first reported hot flashes, palpitation, gas pains and nausea. Postoperative hernia repair and hemorrhoidectomy were done in February, 1931. April 30, 1931, she reported for treatment because of insomnia, hot flashes, paresthesias, depression and contemplation of suicide. Pelvic examination revealed vaginal and cervical atrophy and rectal spasm. Rectal dilatation was done. At this time folliculin was begun in doses of 10 units daily (amniotin). After 5 weeks she reported that she was still having one or more hot flashes each day, but sleep was improved, and the depression was greatly relieved. She began to note that her feet always "felt heavy" since using the therapy. The treatment was changed to 20 units daily (theelin), and the report in one month was that she continued to improve but still noted about one flash per night. Return to the use of 10 units of amniotin for the third month was followed

by still more marked improvement. She felt her best during the first hours after the morning injection. Relief was so complete that she desisted from the treatments after two more weeks. This was in spite of the furnishing of the medication by a charitable group. The visiting nurses who had observed the patient for many months were amazed at the change in personality. The patient returned to work in a beauty parlor and was able to assume most of the support of her four sons.

Four months later she returned because of recurrent vertigo, "nervousness," hot flashes, and insomnia. The urinary tract was also showing signs of inflammatory reaction. She was started on the use of folliculin orally, using progynon tablets. Relief of symptoms has again been definite while taking 30 unit tablets twice daily. (This dose is approximately equivalent to 6 units hypodermically, judging from the use of the material in castrate rats in this laboratory.) This patient has evidently had an artificial menopause induced by radiation, with symptoms appearing slowly as often occurs. The vasomotor and psychic disturbances were no more intense than in a number of the spontaneous menopausal cases included in this series, but the duration of the treatment necessary to obtain relief from symptoms is strikingly greater than that usually observed. Not all the artificial cases have been so refractory, but the only refractoriness has been in the artificially induced menopause cases, so far as the author's experience goes.

This observation about the relatively refractory nature of the artificial menopause leads to speculation about the mechanism involved. It is evident from animal work that the anterior pituitary exerts a stimulating activity upon ovarian development and activity. Likewise the ovary appears to exert a depressing effect on the anterior pituitary, thereby obtaining a dynamic equilibrium. The preliminary results from Fluhmann's clinical material<sup>5</sup> suggest that the menopause may be accompanied by excessive activity of the anterior pituitary. It may be in keeping to suggest here that the vasomotor manifestations of the menopause, at least, might be due to pituitary overactivity. This may be of the anterior lobe, or perhaps associated disturbance of the posterior portion might also be excited. Certainly disturbed or decreasing activity of the ovaries cannot be directly charged with the disturbances, since the symptoms of the menopause occur in most marked form and for periods of years after complete castration. The longer duration and the greater difficulty in management of the artificial menopause cases might be explained by assuming natural tendency of the anterior pituitary to reach a senescent stage of reduced activity in the fifth or sixth decades. If the pituitary and ovarian activity decline together, an uncomplicated climacteric would be anticipated. If the pituitary declined prematurely, the picture would be that of the premature but quiet menopause. But if the pituitary outlasts the ovaries the picture will include the various clinical manifestations usually associated with the disturbed menopause, i. e., vasomotor, neurological and psychic instability. These speculations will become susceptible of test as the methods of assay for ovarian and pituitary hormones in normal blood are elaborated. Progress in this technic is slow, in this laboratory as in others. At present it can at least be said that the above hypothesis is not inconsistent with known facts from the animal work which has been reported in the past decades.

Direct evidence that the pituitary factor per se is a cause of at least the vasomotor symptoms may be near at hand. Several patients have recently been treated in this hospital with follutein, because of amenorrhea or of sexual infantilism. Some of them have reported the disturbances resembling hot flashes, occurring within the first hour or two after the hypodermic injections. Follutein is a preparation from the urine of pregnant women, made in the laboratories of E. R. Squibb and Sons. It is known by animal tests in the laboratory of the manufacturer and in this laboratory likewise that follutein contains factors resembling or identical with the anterior pituitary materials which stimulate follicular growth and also luteinization. Details of these studies will be published shortly.

Incidentally it may be mentioned that in the present series of 32 cases only 13 are obese. A few of these have evidently been obese since before the climacteric was approached. The common clinical tendency to associate obesity with the age of the menopause is by no means always justified. There may of course be more than an incidental connection. The work of Smith<sup>a</sup> demonstrates the obesity which follows disturbance in the hypothalamic region in rats. It is not improbable that the result of castration or of the spontaneous menopause may be an uninhibited activity of the anterior pituitary with consequent disturbance in the neighborhood just sufficient to affect this "obesity center" in some cases. Again there are only 10 of these 32 cases with hypertension, illustrating the inconstant tendency to this manifestation of the menopause. Although the association of hypertension with the pituitary gland is less certain than that of the gland and obesity, the variable picture sketched above may be of significance here also by posterior pituitary disturbances. It is not to be forgotten that the involvement of the adrenal cortex in the gonad hormone system may probably have to be reckoned with in the blood pressure problem.

The preparations of folliculin employed have included amniotin and theelin. The former has been used with equal success in hypodermic injections or in the vaginal suppositories. The choice has been made on the basis of convenience to the patient. Grateful acknowledgement is made to the laboratories of the E. R. Squibb and Sons Company and to Parke, Davis and Company for the supply of much of the amniotin and theelin respectively which has made possible this study. Exactly similar results have been obtained more recently using theelol.

#### SUMMARY

In a series of 32 menopausal cases hot flashes occurred in all, paresthesias in 16, insomnia in 19, and psychotic pictures in 17. Obesity was found in only 13, and hypertension in 10. Of this series 6 had artificial climacteric produced by radiation or surgery, and there were 3 patients with a spontaneous premature menopausal picture, possibly to be considered as ovarian insufficiency.

The use of simple psychotherapeutic procedures and small doses of folliculin daily or oftener has been found very helpful in the psychotic cases as well as in the simpler vasomotor types and the pseudothyrotoxic types previously reported. Disadvantages of large doses of the hormone are pointed out. The refractory nature of the artificial menopause leads to a discussion of the possible relationships of the pituitary and the ovaries at the age of the climacteric.

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## RADIATION THERAPY IN GYNECOLOGIC MALIGNANCY\*

IRA I. KAPLAN, B.Sc., M.D., NEW YORK CITY

*Director Division of Cancer, Department of Hospitals. Visiting Radiation Therapist, Bellevue Hospital*

*(From the Gynecological Service, and the Radiation Therapy Service, Bellevue Hospital)*

TO CARRY out properly the procedure which is necessary to irradiate gynecologic conditions efficiently the radiation therapist must be a clinician and have available a standardized x-ray apparatus and a sufficient amount of radium energy. The therapist must be thoroughly familiar with the physical and biologic factors of radiation therapy, for it is often essential to choose what form of irradiation will be suited to any one case. In a general way we have found it more advisable to use the x-ray (1) for palliative treatment; (2) for curative treatment where large areas must be irradiated; (3) in cases where inaccessible lesions are present; and (4) in conjunction with radium therapy and surgery. Radium, on the other hand has proved most useful (1) for local or surface application; (2) for intraorificial or intra-tumoral treatments; and (3) as a distance pack where large quantities of radium are available.

On account of the economic status and the type patient referred to a free municipal hospital it has not been feasible to obtain completely satisfactory follow-up records. In many instances the patients never return to this clinic and no trace can be found of them at their given address.

The present discussion is concerned with the malignant gynecologic conditions we treated in 280 primary malignant cases during 1924-1931.

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## MALIGNANCY OF THE VULVA

In our series this condition is not common and occurred mostly among women above 50 years of age. During the past 8 years we have had referred to our service only 12 cases, the youngest was 30 and the oldest 74 years of age. Five women were between 51 and 60 years and 3 between 61 and 74 years of age. Only 5 of the women had children although 11 were married. Four were widows. Only one single woman of 56 years of age was referred for this condition. Two women were of the negro race. In 1931, 4 patients were alive and well, 5 were dead, and the result in 3 cases was not known.

Treatment in all cases consisted of a combination of radiation and surgery. Preliminary irradiation of the inguinal lymphatics with high voltage x-rays was followed by surgical removal and where possible with the high frequency current. In extensive cases, intratumoral treatment with radium was carried out, and the remaining growth was removed by high frequency current when the lesion did not respond to irradiation.

## CARCINOMA OF THE VAGINA

Primary carcinoma of the vagina is a rare condition. We have had 4 cases, all in white women. Treatment consisted of x-ray irradiation of the vaginal lymphatics and local radium therapy to the vaginal lesion. Of the four women treated 3 were married, and one was single. The youngest was a married woman of 28 years, and the oldest was a single woman of 35 years. The others were 36 and 45 years of age. Only one had children. Three cases were seen alive in 1929 and one was reported dead.

## CARCINOMA OF THE URETHRA

Urethral carcinoma is occasionally a primary lesion. In our series we have had two cases; both were treated by x-ray therapy to the inguinal lymphatics and suprapubic pelvic areas, followed by radium therapy to the local lesion. In one case intratumoral radium was used; in the other a local application was applied to the surface of the lesion. Both cases were widows aged 60 and 67 respectively, and both white women. Both cases are alive but in poor condition three years after treatment.

## CARCINOMA OF THE CERVIX

Carcinoma of the cervix has been best treated by irradiation. For the past 8 years on the gynecologic service at Bellevue, this method has superseded all surgical methods for this condition. Treatment consists of a combination of x-rays and radium therapy. The x-rays are used to control uterine bleeding, suppressing menstruation altogether, to irradiate possible adnexal involvement, and the associated lymphatic drainage tissues. The cervix lesion is also affected directly by the x-rays. The radium technic is a modified form of that in use at the



Curie Institute in Paris, as previously described by the writer in 1927.<sup>1</sup> For the past two years we have changed our method somewhat. Following the usual course of pelvic x-ray therapy, another course is given one month after the radium has been applied to the cervix. The second treatment of the pelvis by x-rays has been found necessary to take care of recurrences and pain which occurred in many cases which had apparently completely healed as a result of radium treatment.

From our experience during the past 8 years we have found this method very worth while. A statistical report of our cases treated has been given elsewhere.<sup>2</sup> Since publishing this report we have treated 29 additional cases during 1931 or a total of 167 cases and our results have continuously improved. In cases where the local cervix lesion is extensive and cauliflower in appearance, high frequency removal of the tumor growth is done to facilitate the application of the radium. In all cases treatment by radium is applied to both the uterus and the cervix.

#### CARCINOMA OF THE UTERUS

Uterine carcinoma we believe may well be treated by irradiation as well as by surgery. Treatment is carried out by x-ray therapy to the pelvis, acting on the adnexa and uterine body, and by radium inserted into the uterine canal, and, to the parametrium by a vaginal applicator. The radium dosage for the uterus itself must be larger than that employed for the parametrium, it is applied over a long period of time, namely, 5 to 8 days. In advanced cases, or those in which operation is contraindicated, palliative pelvic x-ray therapy alone is employed. We have felt that irradiation is preferable to surgery in these cases but if operative treatment is employed, we advise both pre- and postoperative irradiation.

During the period of 1924 to 1931 there were 54 cases referred to the Radiation Therapy Service for treatment. Fifty-three were white women, and 1 was a negress. A microscopic diagnosis was made in all cases, all of which were of the adenocarcinoma type. Of these, 20 had had a previous hysterectomy. One case had a colostomy for obstruction and no hysterectomy. Thirty-three were treated by irradiation alone; these were patients in whom operation was contraindicated on account of serious associated disease or too far advanced local lesion. Of the 54 cases, 47 were gentiles and 7 were Jewish, 50 were married or widowed, 3 were single women, in 1 the marital state was not recorded.

The youngest was 30 years of age and the oldest 84. Most cases were in the 41 to 50 year period. The age grouping was as follows:

<u>30-40</u>	<u>41-50</u>	<u>51-60</u>	<u>61 and over</u>
8	23	15	8

Of the married women 34 had one or more children, and 14 had none, 3 were not recorded. Twelve are known to be dead, 21 known to be alive,

and 21 condition unknown. Of the 21 living patients 11 had had hysterectomy and irradiation and 10 had irradiation alone.

- 1924— 2 cases—1 known dead 2 years after treatment.  
           1 unknown.
- 1925— 1 case —1 unknown result.
- 1926— 4 cases—1 known dead 5 years after treatment.  
           1 living and fair condition 6 years after treatment.  
           2 unknown results.
- 1927— 6 cases—1 known dead, living 1st year.  
           2 unknown results after 2 years.  
           3 cases living and in good health 5 years after treatment.
- 1928— 6 cases—1 known dead 18 months after treatment.  
           2 unknown results, 1 of these alive 3 years after treatment.  
           3 living and well 4 years after treatment.
- 1929— 8 cases—2 known dead, 1 and 2 years after treatment.  
           3 unknown results 1 and 2 years after treatment.  
           3 living. 2 cases 2 years after treatment, condition poor.
- 1930—16 cases—4 known dead 1 year or less after treatment.  
           1 known died March, 1932—2 years after treatment.  
           3 unknown results.  
           8 living.  
           2 cases 1 year after treatment.  
           6 cases 2 years after treatment, health good.
- 1931—11 cases—1 known dead.  
           3 unknown results after 1st year.  
           7 living at present over 1 year after treatment.

#### CARCINOMA OF THE OVARY

Carcinoma of the ovary when operable is treated preoperatively and postoperatively by x-rays. In our opinion the best results are achieved when the bulk of the tumor growth and adjacent tissues are removed following preoperative irradiation. In cases where ascites is present, the ascitic fluid is withdrawn before irradiation. In advanced cases palliative x-ray therapy to the pelvis is indicated, and in some instances we have seen a previously inoperable case become operable to such an extent as to allow for removal of the bulk of the tumor growth. Further irradiation with x-ray therapy has ameliorated the condition sufficiently to permit a comfortable existence. During the period 1924 to 1931, there were 30 cases treated, 26 by operation and irradiation and 4 by irradiation alone. The youngest was 11 and the oldest was 65 years of age. There was one case of a girl of 15 years of age. The grouping of cases according to age was as follows:

$\frac{11-40}{10}$	$\frac{41-50}{11}$	$\frac{51-65}{9}$
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There were 19 married, 9 single and 2 cases in which the marital state was not stated. Of the 19 married women, 12 had children and 8 had no children. There were 3 patients of the Jewish faith. Twenty-eight were white and 2 were colored patients. The results are as follows:

Nine are known to be dead, and 7 living and well at present, all having been treated by irradiation and surgery. In 14 the follow-up is lacking.

- 1925— 1 case —last seen 1927 good condition.
- 1926— 5 cases—2 dead 1 year after treatment.  
2 unknown after 1 year.  
1 alive and well February, 1932, 6 years after treatment.
- 1928— 4 cases—1 dead during 1st year.  
2 unknown after 1st year.  
1 alive and well 4 years after treatment.
- 1929— 4 cases—1 known dead, 2 years after treatment.  
3 results unknown after 1st year.
- 1930—10 cases—2 known dead during 1st year.  
6 unknown after 1st year.  
2 alive and well, 2 years after treatment.
- 1931— 6 cases—3 known dead in 1st year.  
3 alive and well 1 year after treatment.

#### CARCINOMA OF THE FALLOPIAN TUBES

During the past 8 years we have had occasion to treat two cases of primary carcinoma of the fallopian tubes found upon operation but not preoperatively diagnosed as such. Both cases were white women, ages 29 and 32 respectively; one had had children. One patient is still alive after two years, the other quickly metastasized to the viscera, terminating fatally within a short time. Surgery followed by x-ray therapy was used in both cases.

#### CHORIONEPITHELIOMA

Last year there was referred for irradiation a case of chorion-epithelioma; this was postoperatively treated by x-ray therapy. In our opinion the most efficient procedure for this type of case is surgery plus irradiation. As this is an embryonic type tumor, irradiation should control its further growth and prevent recurrence. This patient was a married white woman, age 44, who had had 8 children previously. She is still alive one year after treatment.

There was one case of teratoma and one case of hydatidiform mole. The case of teratoma was in a single girl of 28. She was treated by operation and radiation but died shortly after treatment. The hydatidiform mole occurred in a white married woman age 35 who had had four children. She was treated by operation and irradiation and is alive and well two years after treatment.

From time to time there have been referred to us for treatment cases of recurrent carcinoma following hysterectomy done elsewhere. The irradiation procedure depends on the condition of the patient and the extent of the recurrent lesion. In many instances the condition is so advanced that only custodial care is indicated. In several cases, however, treatments by x-rays to the pelvis and radium to the vaginal sur-

face of the lesion has completely healed the condition and prolonged life in comfort. Report of the above cases is not included in this paper.

#### CARCINOMA OF THE BLADDER

Carcinoma of the female bladder has been treated by x-rays through the pelvis and occasionally by intratumorally radium therapy in the bladder. In operable cases x-ray therapy suprapubically has suppressed hemorrhage and ameliorated the severity of the pains and has made the later end of the patient's life more comfortable. There were 6 cases in our series in patients over 45 years of age. The most severe symptoms of hematuria were relieved in all cases. There were 3 single and 3 married women.

In our work we have found the direct association with the gynecologic staff very helpful. Their cooperation has proved of value in the several cases of postradiation sepsis. In cases where adnexitis occurs or where the culdesac becomes filled with pus, surgical interference is necessary to relieve the condition and often saves life.

#### CONCLUSIONS

Radiation therapy is an essential aid in the care and treatment of malignant gynecologic conditions.

It is the method of choice in the treatment of cancer of the cervix.

When properly applied, irradiation ameliorates the severity of the disease even in so-called hopeless cases.

Irradiation must be applied only by one trained in the proper use of x-rays and radium, and adequate equipment must be available.

Report is made on 280 cases treated during the period of 1924 to 1931.

Cooperation with the gynecologist is essential in order to achieve the best results.

#### REFERENCES

- (1) Am. J. Roentgenol. October, 1927. (2) Am. J. Roentgenol. November, 1931.

55 EAST 86TH STREET.

## INFORMATION REGARDING GONORRHEA IN THE IMMATURE FEMALE

GOODRICH C. SCHAUFFLER, M.D., AND CLIFFORD KUHN, M.D.,  
PORTLAND, ORE.

(From the Department of Gynecology, University of Oregon Medical School and The Portland, Oregon, Free Dispensary)

IT IS common knowledge that the gonococcus requires for its growth and the development of its pathogenic characteristics, a "harbor of infection." In exposed locations, or where it is subject to even mild noxious agents, or in competition with almost any other bacteria, the gonococcus



Fig. 1-A.



Fig. 1-B.

Fig. 1-A.—Bartholin area in full-term stillborn; *h.g.* groove between hymen and labium minus; *h.* hymen; *d.o.* Bartholin's duct opening just beneath cutaneous surface; *gl.* rudimentary gland tubules. The small square indicates area shown in high power (Fig. 1-B).

Fig. 1-B. High power area outlined in Fig. 1-A. *gl.t.* gland tubules. These are simple early gland tubules, the only glandular structures found in a thorough examination of the tissues of a stillborn and of a thirteen months' infant. Even these rudimentary glandular structures are notably scarce. These were apparently cut just short of their entrance into the duct.

becomes impotent and perishes. Only in the deep stagnant recesses such as the glands of Skene and Bartholin, or the racemose Nabothian glands of the cervix or the deep intricate plicae of the fallopian tubes, do these organisms find their ideal habitat. Accordingly, these foci are the common "harbors of infection" of the gonococcus in the adult female.

In spite of prevalent misconceptions to the contrary, the gonococcus is faithful to its bacteriologic characteristics in the immature female genital

tract. Its pathogenic action on the genital apparatus in female infants and small children is not due, as has been urged, to changes in its bacteriologic properties, or to an hypothetical low resistance of invaded tissues. It is due to mechanical and developmental differences between the immature and mature female genitalia. These differences are sufficiently obvious, but have not heretofore been given the emphasis which they deserve in this connection. They may be summarized as follows:

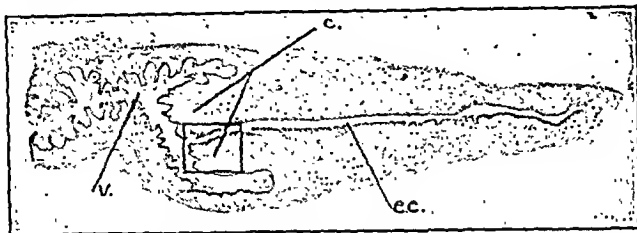


Fig. 2-A.—Microphotograph of complete sagittal section of uterus and vagina of stillborn infant, formalin hardened; e.c. endometrial cavity; v. vagina; c. cervix. Note complete absence of cervical glands and rudimentary nature of endometrial glands. Note also complicated cryptiform vaginal structure, less marked in this specimen than in the average, due to postmortem mechanical distention for purposes of study. Note folds or pleats over entire vaginal cervix.

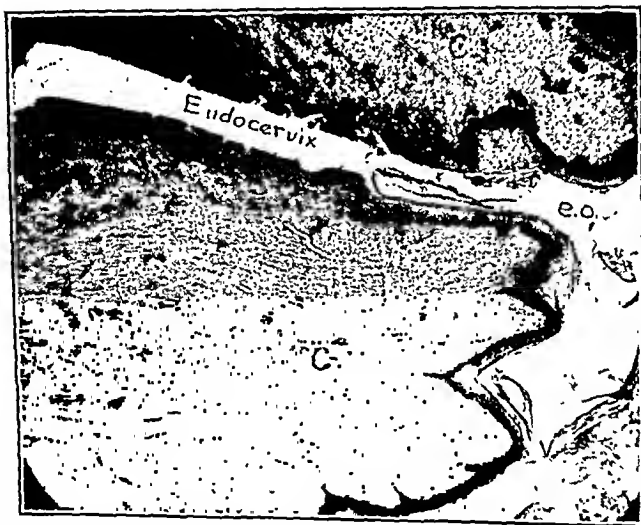


Fig. 2-B.—High power of area outlined in Fig. 2-A, c. cervix; e.o. external os; v. vagina. The entire endocervix is included in this area. Note absence of glands and persistent squamous epithelium at external os, also pleats or folds on vaginal cervix.

1. The glands of Skene, while they may be noted in a rudimentary form in very early stages of development, do not achieve sufficient complexity to become "harbors of infection" until the approach to puberty or later.\*
2. Similarly, the Bartholin's glands, while they may be noted in a rudimentary form as early as the sixth month, do not develop characteristics favorable to the growth of the gonococcus short of fairly complete general sexual development\* (see Fig. 1-A, B).

\*This is borne out by our recent studies and by observations in the literature (which are few). Our studies of these structures in embryos and infants together with pertinent clinical data are being made the subject of a separate paper for publication elsewhere.

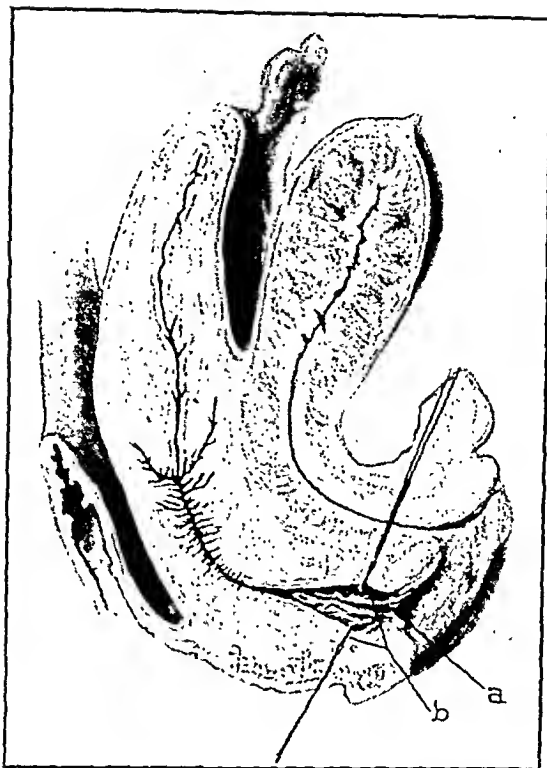


Fig. 3.—Sagittal section of block including bladder, urethra, uterus, cervix and vagina of full-term stillborn female infant. The intricate cryptiform accordion-like conformation of the vagina is clearly shown. At points *b* the walls are spread to demonstrate the deep longitudinal pleats of the lower vagina. The relative occlusion of the hymeneal orifice is shown at *a*. Note the definite plications on the vaginal cervix similar to those of the upper vagina.



Fig. 4-A.—Harmless efficient vaginal distention obtained by author's method. Bismuth subcarbonate (25 per cent) incorporated in the usual ointment base. Child of ten years.

3. The racemose glandular system of the endocervix is very tardy in development, frequently being apparent only as scattered rudimentary, blunt, glandular crypts, up to as late as the fifteenth year\* (see Fig. 2-A, B).

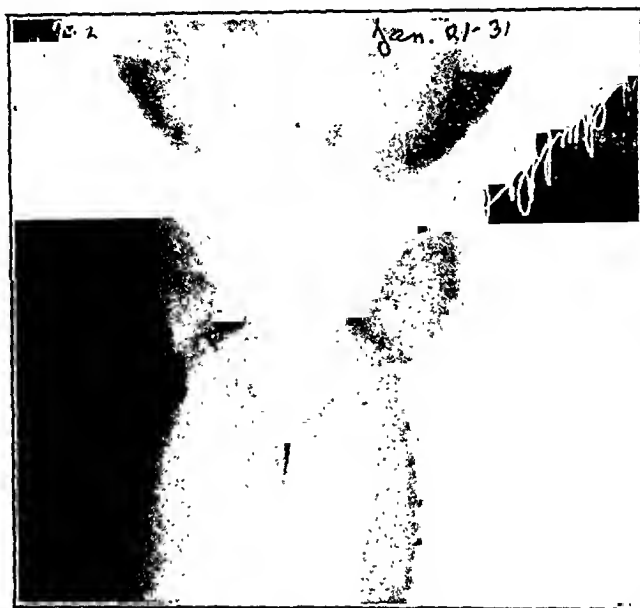


Fig. 4-B.—Same patient as Fig. 4-A three minutes later. The tube has been removed showing that the heavy ointment base maintains the distention and is well retained.

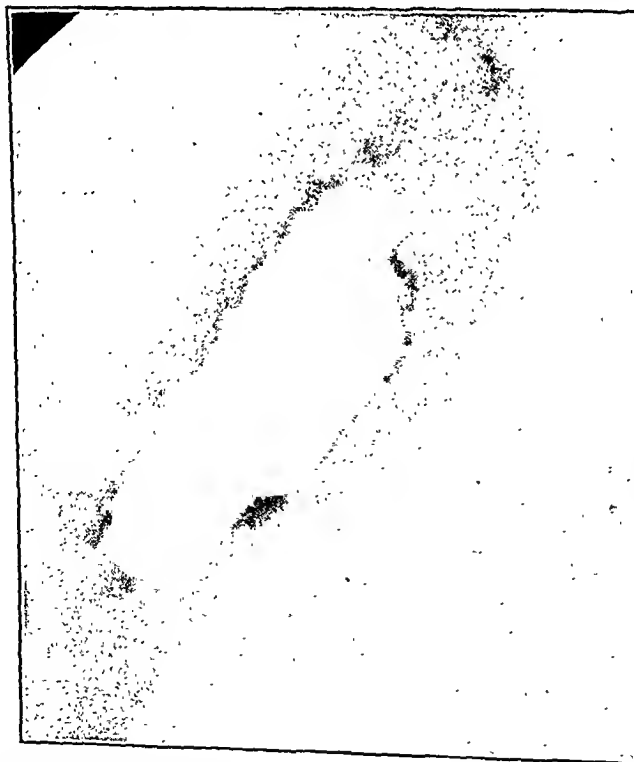


Fig. 4-C.—Lateral view of same patient as in Fig. 4-A. Shows adequate distention. Note invagination produced by the encroachment of the vaginal cervix in the vault.

\*See footnote on p. 375.



4. The immature vagina is merely a potential cavity held in a state of constant closure by its elastic and muscular coat, and replete with stagnant crypts and rugae. Its walls are held tenaciously approximated, much as are wet paper surfaces—this in marked contrast to the flattened gaping vagina of the parous adult (see Fig. 3).

The conclusions to be gained from these observations are obvious and can be summarized:

1. Since the rudimentary Skene's glands of the immature individual offer no harbor of infection, it is not to be expected that infection of clinical importance by the gonococcus will occur. This is borne out by clinical experience.

2. The same is true in the case of the immature Bartholin's glands (Fig. 1).

3. Not only is the immature endocervix practically never infected by the gonococcus, for the reason that the cervical glands are not present in a form to harbor the organisms (Fig. 2) but also, a high degree of immunity is granted through this agency to the endometrium and fallopian tubes. It is my belief that in the immunity of the immature endocervix to gonorrheal infection, we have a satisfactory explanation of the singularly low incidence of salpingitis due to vaginal gonorrhea in the immature.

4. The contracted cryptiform rugose vagina of the immature individual constitutes virtually an ideal "harbor of infection" (Fig. 3). In this factor we have a perfectly satisfactory explanation of the occurrence of a primary vaginitis as the most usual manifestation of gonorrhea in the immature individual. In the adult, the distention and flattening of the vaginal wall with the frequent introduction of bacteria and other noxious agents, entirely alters the conditions favorable to the development of this organism.

We know that, in the adult, the gonococcus is retained in the Skene's and Bartholin's and the cervical glands, and is frequently passed over from the cervical glands to the endosalpinx, while the vagina, except for a transient inflammatory reaction, is immune. We have shown that, on the other hand, in the infant and small child, the vagina is the point of election—the Skene's, Bartholin's, and endocervical glands are relatively non-infectible, and there is immunity of the endosalpinx secondary to that of the endocervix.

It is not sufficiently clearly understood, even by those who have made something of a study of gonorrheal infections in infants, that the vaginal cervix is the seat of deep pleats and folds similar in all respects to those noted throughout the remainder of the vaginal wall (see Fig. 3-A, B), thus, the vaginal cervix is not exempt from an infection which involves the entire vaginal wall. This fact was early noted by Hess in a series of post-mortem examinations. Unfortunately, Hess' observation has been misconstrued. In his own report Hess carefully differentiates between the vaginal cervix and the endocervix. He reports infections of the vaginal cervix only. He has been broadly quoted to the effect that at postmortem he

has demonstrated "cervical infections," with the inference that endocervical infection has been described. This inference is not justified.



Fig. 5-A.—Injection by the method of Gellhorn and Stein, i. e., equal parts of warm vaseline and lanolin (25 per cent bismuth) showing comparatively unsatisfactory distention at height of injection. Child of four years.



Fig. 5-B.—Same patient as Fig. 5-A three minutes later. The catheter has been removed and it is apparent that most of the ointment and medicament have flowed out.

The use of the term "cervico-vaginitis" to describe such infection, while it is perhaps more minutely descriptive, we believe is misleading in that it suggests a frequent involvement of the endocervix as an accompaniment of vaginal infections. Endocervical infection as an integral part of



Fig. 6-A.—Injection per catheter of opaque solution of sodium iodide comparable to the usual instillation. The solution is obviously inefficiently distributed. Child of three years.



Fig. 6-B.—Same patient as Fig. 6-A, three minutes later. There is virtually none of the medicament left. Such an application is clearly transitory and inefficient.

the pathology occurs only in individuals who have reached a stage of advanced development of the cervical glands. It is perhaps an occasional transient accompaniment of severe acute infection of the immature vagina.

The use of the descriptive term "vulvovaginitis" is distinctly a misnomer. The vulvar irritation in these cases is completely secondary, and due to factors similar to those which cause external irritation in pyelitis, diarrhea, etc.

#### INDICATIONS FOR RATIONAL TREATMENT

Douches, instillations, injections, etc., have been used empirically and ineffectually for too many years. These timeworn measures, mildly effective in certain adult involvements, are grossly inadequate to meet the existing indications in any but virtually self-limited cases. The need is for the universal application to the affected area of a reliable antiseptic over a prolonged period of time. Gelhorn and Stein contributed conspicuously in inaugurating vaginal treatment by the use of an ointment incorporating an antiseptic which was injected per catheter in a softened state. The most effective approach to these indications is achieved, however, through the use of a relatively firm ointment base, injected by a technic which insures the production of sufficient intravaginal pressure to cause invasion of the ointment into every crypt and corner. The use of plain anhydrous lanolin incorporating an appropriate concentration of any worthwhile antiseptic is advised. (We use one per cent silver nitrate.) The ointment should not be warm, as its quality of firmness facilitates distention of the vagina with the use of mild intravaginal pressure. Also, it is more easily and completely retained if cold, and has the highest possible fluid affinity, which makes it a highly effective vehicle for carrying the antiseptic into the moist vaginal wall—this in contrast to the usual vaseline base which is repulsed by moisture.

Our clinical studies have been supplemented by the injection of post-mortem specimens by this technic. Clinically, x-ray visualization of the vaginal cavity has been made possible by the employment of opaque media. Using this procedure, we have studied all types of treatment (see Fig. 4, 5, 6). By the method described we have obtained a consistent, complete and satisfactory application of the medicament, which remains in the vagina over periods varying up to forty-eight hours. This has not been the case with other methods conscientiously employed. The use of this method in over 2000 treatments has in no instance resulted in any untoward incident of any sort whatsoever.

The results of the use of this method have shown a surprising and satisfying improvement over other methods in a large series of stubborn cases, in the majority of which several other methods had failed. It is simple, rational, harmless, and effective.

NOTE: Further clinical considerations with reference to the application of this method and detailed instructions in technic may be found in the *American Journal of Diseases of Children*, Vol. 34, Oct., 1927, pp. 644-656, and Vol. 43, Feb., 1932, pp. 350-355.

# SPONTANEOUS EVOLUTION OF THE FETUS IN TRANSVERSE PRESENTATION

NICHOLSON J. EASTMAN, M.D., BALTIMORE, MD.

*(From the Department of Obstetrics, The Johns Hopkins Hospital and University)*

THE phenomenon of spontaneous evolution of the fetus from transverse presentation has been one of unusual interest to obstetricians for various reasons. In the first place, it is an exceedingly rare event, occurring possibly once in 5,000 labors; secondly, it exemplifies nicely what the natural forces of labor may occasionally accomplish when confronted with a seemingly insuperable obstacle; thirdly, it represents the most complicated mechanism of labor; and finally, its beginning stages may be recognized in almost every case of impacted transverse presentation, so that we may regard the latter entity as an example of unsuccessful spontaneous evolution, just as we consider transverse arrest of the occiput as an incomplete stage in the mechanism of occiput posterior positions.

The process of spontaneous evolution was first mentioned by Denman in 1785, but was not accurately described until 1819, when Douglas published his minutely explanatory study based on seven personal cases. Since the reports of these two observers differed considerably, it has been generally assumed that there must be two distinct mechanisms responsible for spontaneous delivery in these cases, the one being designated as the mechanism of Denman and the other as the mechanism of Douglas. In 1915, Stephenson, with the collaboration of the late Dr. Williams, made a study of the original papers of these authors, pointed out that the description of Denman was exceedingly casual and inaccurate and, after describing two cases himself, reached the conclusion that there is but one mechanism of spontaneous evolution, the one described by Douglas.

Observations made in this Clinic upon three additional cases seem to throw further light on this problem and have prompted this report.

In all, five instances of spontaneous evolution of the fetus have been observed here among 147 consecutive cases of transverse presentation, an incidence of 3.4 per cent. This figure is slightly higher than is usually reported, Franqué having observed the phenomenon in 2.5 per cent of his cases, while Zangemeister found only three cases in his series of 232 transverse presentations, an incidence of 1.3 per cent. The histories of our five cases follow.

CASE 1.—The patient was a thirty-three-year-old, colored multipara, para ix, her previous pregnancies having terminated spontaneously under the care either of midwives or private physicians. Her last period had occurred January 18, 1930. She was admitted to the hospital on August 19, 1930, after 43 hours of labor at home, the membranes having ruptured 29 hours before admission. Upon examination the right arm was found macerated and prolapsed into the vagina, while the right shoulder was tightly impacted in the pelvis. No fetal heart sounds were audible. Shortly after admission, during a strong uterine contraction, the fetus could be seen

to descend, the posterior aspect of the right shoulder, the scapular region and the upper right side of the thorax coming into view. Then, with a rotating motion, the lumbar region and the breech appeared, followed by the lower extremities. Finally, with the aid of slight traction and moderate suprapubic pressure, the left arm and head were easily delivered.

The fetus, which was stillborn and macerated, weighed 2600 grams and measured 49 cm. in length with a crown-rump length of 34 cm. The head, which was greatly distorted, lay flattened against the trunk, being bent on the elongated neck sharply to the left.

The placenta was delivered spontaneously. After a febrile course, the patient was discharged well on the thirteenth day postpartum. On discharge examination, she was found to have a generally contracted, funnel pelvis, the diagonal conjugate measuring 11.0 cm. and the outlet diameter 7.5 cm.

CASE 2.—The patient was a twenty-three-year-old, colored multipara, whose one previous pregnancy had terminated spontaneously. Her last menstrual period had occurred on June 20, 1922. When admitted to the hospital on February 10, 1923, she was in beginning labor with a small baby lying in transverse presentation, the fetal heart sounds audible. After seven and one-half hours of labor, it was found that the membranes were bulging through the introitus and preparations were made to rupture them and follow this with version and extraction. Before this could be done, however, the left arm and shoulder prolapsed. With the next pain the back, which had been directed toward the rectum, rotated anteriorly and at the same time became bent upon itself in such a manner that its convex aspect was directed toward the maternal sacrum. This permitted the breech to be born, followed by the lumbar region and legs. The head now rotated so that the occiput was directed anteriorly and was readily delivered with the aid of slight traction. The entire procedure, from the time the shoulder appeared at the outlet until the head was born, required a period of less than three minutes.

The fetus, which was stillborn, weighed 1750 grams. Its length was 42.5 cm. with a crown-rump length of 28 cm. The mother, whose puerperium was uneventful, was discharged well on the fourteenth day of the puerperium. Her Wassermann reaction, however, was positive.

CASE 3.—The patient was a twenty-five-year-old colored multipara, para v, the previous pregnancies having all terminated spontaneously. Her last menstrual period had occurred on August 24, 1911. When she was admitted to the hospital on April 30, 1912, a small child was found in transverse presentation; the fetal heart sounds were not audible. After ten hours of labor, the membranes ruptured at complete cervical dilatation, and at the same time the right arm prolapsed. With the next pain the shoulder came into view, followed by the back, breech and lower extremities. The left arm and head were readily delivered by means of slight traction.

The fetus weighed 2010 grams and measured 47 cm. in length. The mother subsequently died of puerperal infection.

CASE 4.—The patient was a twenty-seven-year-old, white multipara, who was delivered of a 2690 gram, stillborn fetus, by spontaneous evolution after seven and one-half hours of labor. (Reported in detail by Stephenson.)

CASE 5.—The patient was a twenty-six-year-old colored multipara, who was delivered of a 2500 gram, stillborn fetus, by spontaneous evolution after twenty-six hours of labor. (Reported in detail by Stephenson.)

It will be noted that the smallest infant in the group weighed 1750 grams and the largest 2690 grams, a range of weight into which most babies born by spontaneous evolution fall. Spontaneous delivery of fetuses weighing less than 1500 grams is not uncommon in transverse

presentation, but in those instances delivery is usually effected not by the mechanism of spontaneous evolution, but by the simpler process of conduplicatio corporis. On the other hand, infants weighing over 2700 grams are usually too large to undergo the compression necessitated by spontaneous evolution, although a few exceptional cases are on record in which the child exceeded 3000 grams. (Busch, 3500 grams; Kleinwachter, 3020 grams; Herrgott, 3300 grams.) It seems of interest also to note that in three of our five cases, the duration of labor was less than 10 hours; moreover, it was observed repeatedly that once the process had begun, it was completed with great rapidity, so that, as in Case 2, the entire procedure from the time the shoulder appeared at the outlet until the head was born, required less than three minutes.

Turning now to the question of the Denman and Douglas mechanisms, it must be recalled that during the past hundred years, German obstetricians have reported, collectively, a large number of cases of spontaneous evolution, and in each instance apparently have been able to distinguish between the two mechanisms and to classify their cases accordingly. Moreover, Stephenson himself, in describing his first case, observes that "the position of the buttocks is very unusual, is particularly difficult of explanation, and seriously complicates the classification"; and he concludes that "it would appear best to classify it as an instance of an abnormal or complicated Douglas mechanism." From these facts it is apparent that the process of spontaneous evolution presents sufficient variation to give the semblance, at least, of two distinct mechanisms. The alleged difference between the two processes seems to center on the fact that in one of them the breech appears immediately after the prolapsed shoulder (the mechanism of Denman), while in the other the lateral aspect of the thorax follows the prolapsed shoulder, the breech being delivered only after the thorax as well as the abdomen have been extruded (the mechanism of Douglas). Concerning the intrinsic mechanism responsible for the expulsion of the fetal parts in this or that order, the literature offers only vague and contradictory explanations. From a study of the five cases described in this report, we believe that some degree of clarity might be gained if the two apparently different processes of spontaneous evolution were considered in the following manner:

*Mechanism No. 1.*—Following the prolapse of one arm, the corresponding shoulder and scapular region are forcibly driven into the pelvis by uterine contractions. Since, under these circumstances, there is no room in the true pelvis and little in the false pelvis for an object as large as the fetal head, the latter remains stationary with the result that the neck becomes elongated. These conditions are shown in Fig. 2. The crucial process now takes place; namely, an extreme lateral flexion of the spinal column due to downward pressure on the buttocks, so that the latter are forced down beyond the shoulder and expelled. A moment's consideration of Fig. 2 will make it clear that this lateral flexion may occur in one of two directions—the breech may be forced either toward or away from the prolapsed arm. In the specific case shown in the drawing, the fetus is represented as lying in the posterior half of the uterus, so that the specimen is viewed from the front. Now, if the breech in this case is

driven down towards the prolapsed arm (the convex aspect of the bent spinal column being directed toward the maternal sacrum), the buttocks will be born immediately after the prolapsed arm not only because the lateral flexion of the trunk will produce a certain drawing up of the prolapsed shoulder but also because the descending breech will tend to hide the lateral aspect of the infant's thorax from view. This process we are designating temporarily as mechanism No. 1, and believe that it is characterized essentially by the fact that the buttocks are driven down in the direction of the prolapsed arm, the breech necessarily being expelled before the lateral aspect of the thorax appears. This mechanism, it would appear, is the one usually designated by the name of Denman, but since that author reported only that the "breech and inferior extremities are expelled before the head," it seems hardly justifiable, as pointed out by Stephenson, to attach his name to it.

*Mechanism No. 2.*—This process of spontaneous evolution, in our opinion, differs from the one just described in that here the buttocks are forced down in the direction of the shoulder which is not prolapsed, with the result that the convex aspect of the arched trunk necessarily protrudes through the maternal vulva, followed by the lateral wall of the abdomen and finally the breech. This mechanism has quite rightly been given the eponym of Douglas, who emphasized the fact that in his cases the side of the infant's thorax was born before the breech.

For the sake of clarity, we have considered the process of spontaneous evolution as exhibiting two separate and distinct mechanisms. It must be apparent, however, that various gradations will exist in the mechanisms as described, depending on whether the flexion of the spinal column is directly lateral or only partly so; and for this reason it seems more logical to presume that we are dealing with variations of but one mechanism, an extreme lateral flexion of the fetal back. The precise order in which the fetal parts are born becomes then a secondary matter, dependent upon the direction which this flexion assumes in relation to the prolapsed shoulder.

While our acquaintance with the later stages of spontaneous evolution is based upon many careful observations of the process, our exact knowledge of its earlier stages is founded chiefly upon a few rare cases in which the mothers have died while the process was under way and in which frozen sections have been made of the maternal torso in such a way as to show the exact relationships of the fetal parts. Such a case was Chiari's, reported in 1878. Since in this country, at least, it will be rarely, if ever, possible to obtain such specimens, it has seemed worthwhile to make similar studies on cases in which the fetus was in the early stage of spontaneous evolution and in which the uterus was removed unopened. The specimens from two such cases are shown in Figs. 1 and 2. In each instance the unopened uterus with the fetus in situ was hardened for a suitable period in formalin and was then carefully opened without moving the fetus; the whole specimen was then drawn to scale by an artist.

Brief histories of these two cases follow.

FIG. 1.—The patient was a twenty-eight-year-old, colored multipara, para iv. The membranes ruptured prematurely, labor pains ensuing an hour later; the fetus lay in transverse presentation. After thirty-one hours of labor the cervix was still



only 3 cm. dilated despite the fact that an intrauterine bag had been in place during the previous twelve hours. At this time, the patient's temperature was 101.6° and her pulse 130, while the fetal heart was no longer audible. In view of the evident intrapartum infection it was decided to remove the bag and perform hysterectomy on the unopened uterus. This was done, a loop of cord prolapsing as the bag was taken out. The mother was discharged from the hospital on the twenty-fifth day postpartum after a febrile convalescence.

The amputated uterus, which presented a trefoil shape with its greatest diameter transverse, measured 21 by 20 by 17 cm. The cervix was 2.5 cm. in diameter and was occupied by a loop of cord.

The conditions found upon opening the uterus are shown in the illustration. The male child weighed 2000 grams and was compressed into a triangular mass 19 cm.

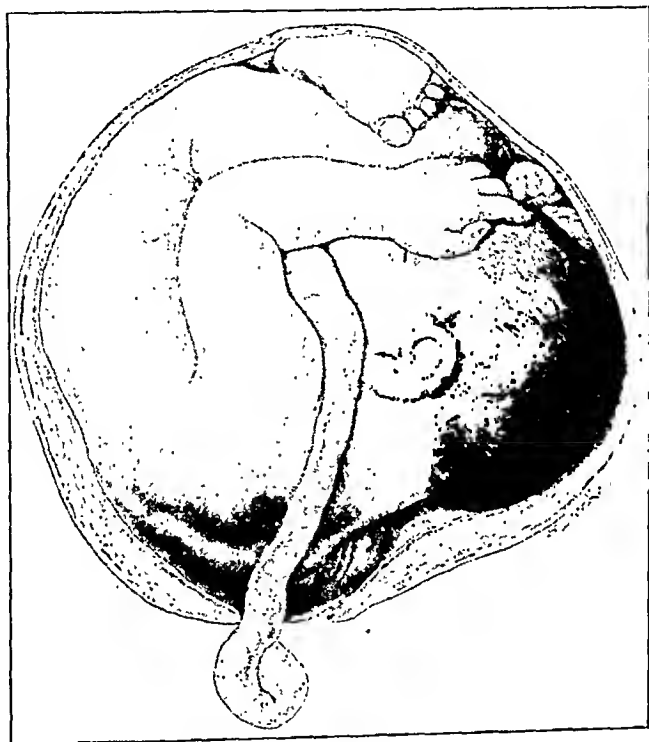


Fig. 1.—Showing the beginning stage of spontaneous evolution, particularly the descent and moulding of the shoulder with caput succedaneum formation upon it.

wide, 16 cm. long and 11 cm. thick. Its left side lay anteriorly and the child was so compressed as to occupy the smallest possible space. The body was flexed on itself so that the face was in contact with the knees and feet, which were crossed on one another. The left arm was flexed with the entire forearm and hand fitted into the space between the thighs and face. The shoulder occupied the lower, and the region of the left knee, the upper pole of the specimen. On the right side the conditions were essentially the same, except that the region over the right shoulder was circumscribed over an area of 10 cm., was somewhat edematous, and represented a "caput succedaneum." It should be noted that the right acromium was the center of this area.

While the placentation was normal, sections from all parts of the uterine wall showed inflammation of the decidua and the passage of leucocytes into the muscularis, a process that occurred even in the fundal region. In the chorionic connective tissue both streptococci and bacilli were demonstrable.

FIG. 2.—The patient was a twenty-eight-year-old colored multipara, who had not been registered on the service. Her membranes ruptured prematurely, labor ensuing in about twelve hours. After twenty hours of labor at home, where one or more vaginal examinations had been made by a private physician, she was admitted to the hospital with a temperature of  $103.8^{\circ}$  and a pulse ranging between 150 and 180. Examination showed that the uterus was tetanically contracted around a small child in transverse presentation, whose right arm was prolapsed into the vagina; the fetal

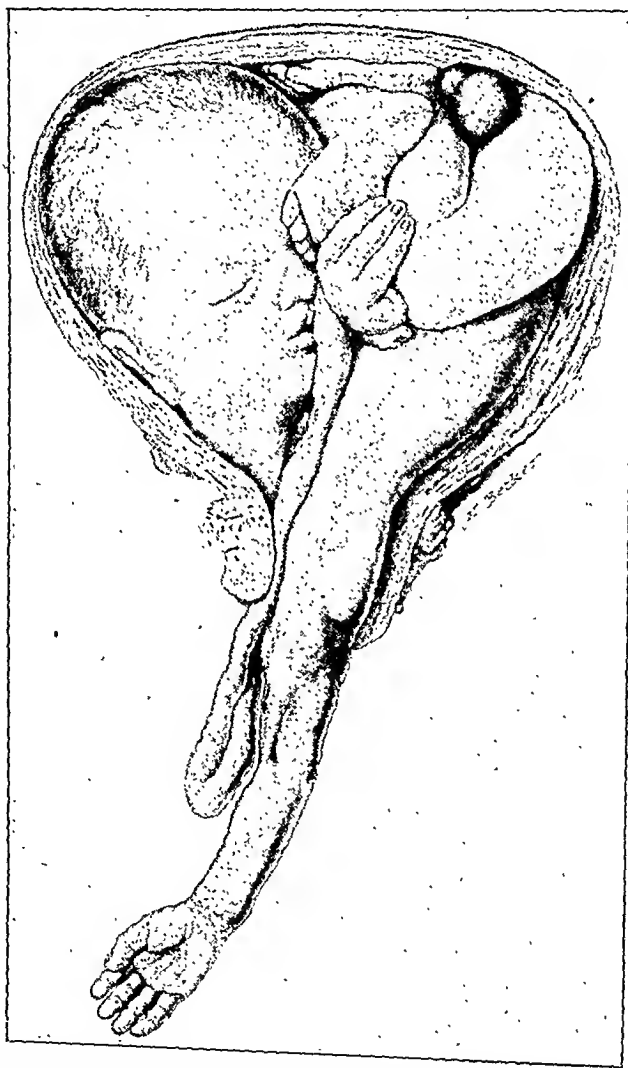


Fig. 2.—Showing another early stage of spontaneous evolution, in which prolapse of the arm, moulding of the shoulder and elongation of the neck have occurred.

heart sounds were not heard. The cervix was 3 cm. dilated. The patient was delivered by hysterectomy on the unopened uterus of a 2000 gram, stillborn fetus. The mother died immediately after the operation.

The unopened uterus, after hardening overnight, formed an oval mass 22 cm. wide, 22.5 cm. high and 16 cm. thick. The specimen was opened by a frontal incision in the plane of the tubal insertions, when it was found that the child lay in R. Ac. D. P. position, with the head occupying the entire right half of the left upper pole. The cervical canal was occupied by the elongated right shoulder; while the

base of the neck was in contact with the right, and the right side of the thorax with the left aspect of the internal os.

The fetus was as closely packed as possible, and it was apparent that every trace of amniotic fluid had escaped. Nowhere was there any evidence of a contraction ring, the thickest part of the uterus, indeed, corresponding to the lower segment, while its thinnest part was above the tubal insertions. Microscopic studies of the uterus showed a fulminant, ascending infection.

In conclusion, the writer wishes to acknowledge his indebtedness to the late Dr. Williams for his advice and his active assistance throughout this study.

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### POSTMENOPAUSAL BLEEDING

SAMUEL H. GEIST, M.D., AND MORRIS MATUS, M.D., NEW YORK, N. Y.

(From the Gynecological Service and Laboratories of Mount Sinai Hospital)

**W**ITHIN the past few years a new impetus has been given to the study of postmenopausal bleeding. While it is true that in the majority of cases a malignant neoplasm is the etiologic factor, it has been pointed out that in a large group of cases, lesions both inflammatory or of benign neoplastic nature may be the underlying causes. A statistical study comparing the etiologic factor as malignant or not malignant, and the relative proportion of the two groups is interesting and instructive, but the more important aspect is the one dealing with the pathologic physiology. The appearance of uterine bleeding, associated with a non-ulcerative lesion, from a mucosa that is no longer sensitized and no longer undergoes a cycle because of the exhaustion of the ovarian function is a fascinating but still unsolved phenomenon.

Moulonget and Doleris published 7 cases of ovarian tumors with postmenopausal bleeding. In 2 cases there was present an hypertrophy of the mucosa, associated in 1 with an endometrial polyp. In 3 cases polyps only were present. One case of endometrial hypertrophy was associated with a granulosa cell tumor.

Robert Meyer reported 7 cases of postmenopausal bleeding with ovarian tumors and hyperplasia of the uterine mucosa. In this series there was 1 fibroma, 1 round sarcoma, and 1 angiosarcoma. In addition there were 3 granulosa cell tumors and one folliculoma carcinomatodes. He suggested that the tumors per se, may have an endocrine function in the granulosa cell type, or may stimulate a latent ovarian function in other types.

Schiffman has published some important data on the subject of postmenopausal bleeding. By postmenopausal bleeding he means vaginal bleeding appearing one year after complete cessation of the regular menstrual period. He mentions numerous cases due to local ulcerative lesions, as decubitus ulcers in prolapse, carcinoma of the

uterus, senile vaginal ulcers, myomata and polyps. He is also inclined to attribute some cases to vasomotor changes. He described cases of ovarian neoplasms, one a woman seventy-two years old, who thirty-two years after the menopause, had had two episodes of vaginal bleeding associated with a mucoid carcinoma of the ovary. He believes that the first symptom of carcinoma may be bleeding.

He groups his cases into three types: (1) Bleeding caused by visible lesions; (2) bleeding caused by corpus lesions, and (3) bleeding caused by indefinite lesions.



Fig. 1.—Normal endometrium in a patient forty-four years of age with postmenopausal bleeding two years postmenopausal.



Fig. 2.—Hypertrophied endometrium in a postmenopausal bleeding case, seventy-four years old, twenty-one years postmenopausal. No other lesions found.

In Groups 2 and 3 he had 51 cases: 2 myomas and polyps; 11 polyps; 14 fundal carcinomata; 8 ovarian carcinomata, and 16 not defined. He accepts the presence of polyps as a true etiologic factor. The proportion of ovarian carcinomata, 16 per cent is quite imposing. He concludes that if curettage in an indefinite case shows necrotic or atrophic tissue one should wait. If hypertrophied mucosa is obtained and no palpable ovarian tumor can be found, it is wise to wait. If this is not practical a laparotomy should be done. If an ovarian enlargement exists surely operate.

Lahm, reports a case of carcinoma of the ovary and a corpus luteum cyst. He too believes that the tumor may have an endocrine function or may stimulate the ovary even after the menopause.

Bentlin in an excellent article finds 60 per cent of postlimenaric bleeding benign. In only 10 per cent of the cases of corporal bleeding, postmenopausal, is the underlying lesion malignant.

He too divides the benign cases into three groups. (1) Inflammatory; (2) polyps; and (3) negative.

In the first group the history is one of a bloody vaginal discharge for a long period. Most patients are well along in the menopause. By curettage one obtains a little mucosal tissue some with necrosis and inflammatory infiltration. This simple operative procedure is curative.

In the second group, twenty-five per cent of all the cases, there is usually a history of sudden bleeding with no previous hemorrhagic discharge. The uterus is large. There is no relation between the size of the polyps and the amount of bleeding.

In the third class he groups the ovarian tumors, which he believes are purely coincidental lesions. He stresses the rôle played by arteriosclerosis.

In addition to the above-mentioned articles, a number of other papers have appeared. There have been publications dealing with the etiologic factors in this type of bleeding and much speculation on the mechanism of postmenopausal hemorrhages. The references to these articles will be found at the end of the paper.

TABLE I. BENIGN LESIONS ASSOCIATED WITH MENOPAUSAL BLEEDING

	NUMBER	HYPERTROPHIC ENDOMETRIUM	OVARIAN CYSTS	POLYPS	ADENOMYOSIS	OVARIAN MALIGNANCY	FIBROIDS	CARCINOMA OF UTERUS	CARCINOMA OF FUNDUS	SALPINGO- OOPHORITIS
Polyps	29	1	3			1	2			
Fibroids	15	3	12	1	1	2		1 <sup>a</sup>		
Adenomyosis	3		1 <sup>a</sup>	2			1 <sup>a</sup>	1 <sup>a</sup>		
Ovarian Tumor										
benign	11			3	2 <sup>a</sup>		3	2 <sup>a</sup>	1	1
Negative	13									
Endometritis and Endocervicitis	11									
Hypertrophic Endometrium	10			1		2	3			

We have studied a series of cases and have found in a total of 182, that 42 per cent were benign, of which 10 cases were benign ovarian lesions, the remaining 68 were benign cervical or uterine conditions. Some of these lesions were associated with benign lesions in other portions of the generative tract.

In the total number of benign lesions of the cervix and fundus we found a wide variety of conditions (Table I). We have not tabulated the cases due to systemic disease.

The histories of the cases (Table II) showed no differential character-

istic except that after a definite period of physiologic menopause ranging from one year to twenty years the patient was admitted to the hospital complaining of vaginal bleeding either in the nature of intermittent or continuous spotting or bleeding of from two days' to two years' duration. At times the bleeding was described either as profuse or scanty, at times associated with clots. Physical examination, curettage or laparotomy revealed the benign nature of the lesion and a subsequent period of observation, over a period of one year, demonstrated that the patient remained cured.

TABLE II. BENIGN LESIONS AND SUMMARY OF SYMPTOMS

	NO.	AGE	MENOPAUSE DURATION	BLEEDING AND SPOTTING
Polyps	29	52-70 yr.	1 to 21 yr.	1 week to 2 years
Hypertrophic Endometrium	10	46-67 yr.	6 to 20 yr.	Profuse-Constant 1 week to 3 months
Fibroids	15	50-62 yr.	1 to 12 yr.	Moderate-Scanty 1-6 months
Adenomyosis	3	50-57 yr.	1 to 1½ yr.	Profuse and Scanty 1 week to 1½ months
Ovarian Tumors benign	11	45-70 yr.	1 to 20 yr.	Slight-Profuse 1 week to 2 months
Negative Endometritis and Endocervicitis	13	44-68 yr.	1 to 29 yr.	Slight 1 week
	11	46-66 yr.	1½ to 20 yr.	Spotting 1-2 weeks

There were 29 cases of cervical adenomatous or fibroadenomatous polyps. Of these cases six were associated with benign lesions of the uterus (Fig. 3), or ovaries which may have been the dominant factor in the causation of the bleeding. The duration of the menopause was from one year to twenty-one years. The bleeding was the only symptom and was described as a spotting, intermittent or continuous, varying from one day to two years' duration. The removal of the typical adenomatous polyps cured the patient.

In one instance, a patient of Dr. Edward Bleyer's, the history and subsequent cure is most interesting and instructive. The woman was sixty-four years of age, had had her menopause nine years previously. She had been complaining of a moderate vaginal bleeding and on physical examination nothing was found except a small cervical polyp. This was removed but the bleeding continued. Several months later a small tumor was felt in the region of the right ovary and a laparotomy was done. An ovarian adenocarcinoma was found and removed. The uterus was left as was the other ovary. The bleeding stopped promptly and the patient has remained well. It is difficult to avoid the conclusion that the ovarian carcinoma was a factor in the bleeding.

One case described as a vaginal hemangiomatous polyp with a history of three days' bleeding, seven years postmenopausal, was cured by removal of the polyp.

In ten instances examination failed to reveal any lesion other than a

hypertrophied endometrium, except for the presence of an adenomatous polyp in one case. In these cases the ages varied from forty-six years of age with a menopause duration of six years to sixty-seven years of age with a menopause duration of twenty years.

The histories here were slightly different from the polyp type in that the bleeding was more constant, more profuse, and in one instance described as being marked with large clots. The duration was from one week to three months. In this group evidently the bleeding, in contradistinction to the cases with cervical polyps only, was too profuse to neglect for a long period of time. A curettage with a diagnosis of hypertrophied endometrium, a negative physical examination and symptomatic cure for a period of over a year leads to the natural conclusion that this benign lesion was the factor associated with bleeding. What is the cause



Fig. 3.—Uterine mucosa showing hyperplasia associated with fibromatous cervical polyp in a postmenopausal bleeding case sixty-four years old and twenty years postmenopausal.

of this hypertrophy is purely speculative. A reawakening of the ovarian function, a vicarious action on the mucosa from some other ductless gland, some local stimulation to the endometrium with subsequent bleeding, all may be offered as hypotheses with no definite proof. Why a curettage relieves these cases and not those occurring before the menopause is impossible to answer.

Fifteen cases of fibroids, in six instances associated with other lesions that might be regarded as possible causal agents were studied (Fig. 4). In two cases ovarian cysts, one a dermoid, one a simple cyst, were present. In one a benign polyp of the cervix existed. In one an adenomyosis of uterus, and in two malignant tumors one of the ovary and one of the tube were found. Here the menopause had existed from one to twelve years. The bleeding was reported as moderate or scanty, as persistent or intermittent, and in duration from one day to six months. Hysterectomy was

resorted to, as the physical examination made it clear that a tumor, the exact nature of which could not be determined, was present. Here again the question of the mechanism of the bleeding was not clear. Was it due to pressure, erosion, congestion or a reawakening of some latent endocrine ovarian function?

In three instances of adenomyosis there were associated lesions that might have been important factors. In these cases the ages were fifty-seven, fifty-five, fifty, the menopause 5 years, 1½ years, and 1 year respectively. The bleeding in the one case associated with fibroid, cyst and carcinoma of tube was profuse. Staining irregular for two days on three occasions over a period of 1½ years was the history in the case associated with an adenomatous polyp. In the third case, a patient fifty years of age with a menopause duration of one year, giving a history of profuse



Fig. 4.—Hypertrophied endometrium associated with fibroids in a postmenopausal bleeding case fifty-one years old and two years postmenopausal bleeding.

bleeding for one week, had an adenomatous polyp associated with the fibroid. The cases were cured by operation.

In eleven instances of benign ovarian tumors, three were dermoids. One associated with a salpingo-oophoritis, one associated with a fibroid subserous in character, and one associated with fibroid, adenomyosis and a primary carcinoma of the left tube. The ages here were forty-five, fifty-three, and fifty-seven, the menopause one and one-half years, four years and five years, respectively. Two of the cases, the one associated with fibroid and the one with a salpingo-oophoritis had slight bleeding for eight years in one case, and for two weeks in the second, while the case associated with the fibroid, adenomyositis and primary tubal carcinoma had a history of bleeding on two occasions, six months and two months ago, for a few days and profuse bleeding with cramps two weeks. Here too the mechanism of the bleeding permits of many hypotheses none of which can be proved.



Of the eight other cases there were three simple cysts, one twisted, four pseudomucinous and one case noted as cystic ovaries. In four instances there were associated lesions. In three adenomatous cervical polypi, one with a simple cyst and two with pseudomucinous cysts and in the fourth there was a fibroid associated with a simple cyst. The ages varied from 46 to 70 years, the menopause duration from one year to twenty years. The history in most instances was that of staining noticed only recently, except in the case with cystic ovaries, where seven days' bleeding occurred on two occasions in two years. This case must be looked upon probably as an incomplete menopause. One other case, a sixty-three-year-old woman with a menopause duration of eight years gave a history of bleeding four weeks. At operation a pseudomucinous cyst was removed. This patient continued to bleed and was subsequently operated upon for a carcinoma of the fundus. It is important in a postmenopause bleeding case that presents a benign lesion and continues to bleed after the eradication of the presumed benign etiologic factor, that the possibility of a malignant condition of the generative tract should be entertained. This was also illustrated in the case previously mentioned with an adenomatous polyp and ovarian carcinoma.

Thirteen cases were found in which it was impossible by physical examination or curettage to find any lesion (Fig. 1). The follow-up as far as was possible to determine showed that these cases remained well. The ages varied from forty-four to sixty-eight years. The menopause duration from one year to twenty-nine years. The bleeding in most instances was described as scanty for a day or two and in several instances as a slightly bloody discharge. In one it was only noted postcoital. Two of these cases could be dismissed as incomplete menopause and two had a senile colpitis. The endometrium obtained by curettage in all instances was negative, in most of the cases being very scanty in amount, and reported atrophic or normal.

In eleven instances inflammatory processes were the lesions associated with the bleeding. In three the diagnosis of pyometra and inflamed corporeal or cervical mucosa was made. The ages varied from fifty-six to sixty-six. The menopause duration was one and one-half to twenty years. The bleeding was in the nature of spotting, in most instances of short duration. Here, too, curettage resulted in cures as well as could be determined. Of course, the basic inflammatory change in the mucosa might readily explain the occurrence of bleeding.

From the above it is evident that many lesions of benign nature (a number of considerable dignity, 42 per cent of our series of cases) can be associated with postmenopausal bleeding.

In our series of postmenopausal bleeding, 57.5 per cent were malignant. There were 5 cases of carcinoma of the vulva or vagina. In 37 cases, carcinoma of the cervix was present and in 41 cases, carcinoma of the fundus. Of the 15 malignant ovarian cases 3 were sarcomatous and 12

carcinomatous, in one instance a fibroid was also present. The ovarian tumors represented 14 per cent of the entire group, 8 per cent of the whole series being due to malignant ovarian tumors (Table III).

TABLE III. MALIGNANT CASES ASSOCIATED WITH POSTMENOPAUSAL BLEEDING

<i>Carcinoma of Vulva and Vagina</i>	5
<i>Carcinoma of Cervix</i>	37
<i>Carcinoma of Fundus</i>	41
<i>Carcinoma of Ovary</i>	12
<i>Sarcoma of Ovary</i>	3



Fig. 5.—Hypertrophied endometrium associated with a spindle cell sarcoma in a case of postmenopausal bleeding fifty-five years of age and eight years postmenopausal.

The ages varied from forty-four with a menopause duration of three years, to sixty-five with a duration of fourteen years. The bleeding was described usually as irregular spotting, or slight bleeding at intervals. In all instances a palpable tumor was present except in the one case reported to me by Dr. Edward Bleyer.

In the case of sarcoma of the ovary, one spindle cell tumor was associated with marked mucosal hypertrophy (Fig. 5).

In a case of primary carcinoma of the tube with bleeding five years after the menopause, the presence of adenomyosis and fibromyoma might account for the the bleeding as well as the possibility of bleeding from the tubal neoplasm with leakage through the cervix. The remaining group of carcinoma of the cervix and fundus require no especial mention as the bleeding associated with their presence is easily explained on the basis of an ulcerative lesion.

## COMMENTS

We can safely venture an explanation as to the etiology of the bleeding in these postmenopausal cases in many instances. In the group of ulcerative lesions such as surface malignancy or carcinoma of the cervix or fundus, or angiomatous conditions, such as polyps or inflammatory processes, the cause of the hemorrhagic discharge is evident. In the presence of large benign tumors pressure and the resultant change in the vascular architecture of the uterus may possibly be a factor.

In the cases where only a negative or normal mucosa was obtained (Fig. 1), in the absence of any local or constitutional disturbance, it is possible that the pituitary function is at fault. Fluhman has shown that there is an increase of the anterior pituitary hormone in the circulating blood after the menopause and Hartman has caused bleeding in castrates by the exhibition of anterior pituitary hormones.

In those cases, however, in which benign hyperplasia of the mucosa of the uterus either as the only lesion or associated with ovarian cysts or fibroids cause uterine bleeding we are led into the realm of conjecture and hypothesis. It is only natural to drag into the explanation the relation of ovarian function, mucosal hyperplasias and coincidental bleeding (Figs. 2, 3, 4). In the cases associated with malignant ovarian tumors (Fig. 5) Meyer and others have ascribed the bleeding to an endocrine function of the tumor itself or to a reawakening of the dormant ovary with a subsequent hypertrophy of the mucosa of the uterus.

Dr. Robert T. Frank in one case of medullary carcinoma of the ovary in a child of nine years found a large amount of female sex hormone in the tumor. Whether this same phenomenon is present in carcinomata in women past the menopause remains to be proved. If this is the case it will corroborate the hypotheses of Robert Meyer, that the endocrine function of the tumor itself is a factor in the postmenopausal bleeding associated with malignant neoplasms of the ovary.

In the small series of benign ovarian and uterine neoplasms associated with hypertrophied endometrium we did not find in the uterine discharge those elements which were previously described in other publications as characteristic of menstrual blood (Geist). It is possible that subsequent investigations may identify these cases as reawakening ovarian activity with menstrual bleeding of pathologic nature. This fact can be determined by proper investigation of the circulating blood for the presence of female sex hormone in the postmenopausal cases. Should this be present and should vaginal blood show the characteristic morphologic elements we would be in a position to state more definitely that the bleeding associated with a nonulcerative lesion was due to a process comparable with the normal menstrual one, due to a reawakening of the dormant ovary or to the endocrine secretion of the tumor.

To summarize, this study demonstrates:

1. Postmenopausal bleeding may be due to either malignant or benign conditions. Benign, in a large group, 42 per cent.

2. It emphasizes the importance of a proper follow-up in those cases especially, where after the removal of a benign condition, the bleeding persists.

3. The importance of a study of the circulating blood and the tumor for the presence of hormones that may lead to a clearer understanding of the mechanism of the bleeding.

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100 EAST SEVENTY-FOURTH STREET.

## A CLINICAL PATHOLOGIC STUDY OF 303 CONSECUTIVE ABDOMINAL HYSTERECTOMIES

A. SAMUELS, M.D., F.A.C.S., AND E. S. EDLAVITCH, A.B., M.D.,  
BALTIMORE, MD.

(From the Gynecological Department, Sinai Hospital)

THIS study was made of all hysterectomy operations performed at the Sinai Hospital from July 1, 1926, to July 1, 1931. The operators were members of the gynecologic and surgical attending staffs and the surgical resident, whose work was closely supervised.

Three hundred and twenty-three uteri were removed, of which 303, or 99.4 per cent, were excised by the abdominal route, and twenty, or 0.6 per cent, by the vaginal route. All the patients were white; two hundred and thirteen (70 per cent) were on the private service, and ninety (30 per cent) were on the house service. Ninety per cent were married women; 78 per cent of these patients having given birth to one or more children. The youngest patient in this series was a girl, seventeen years of age, with a marked chronic pelvic inflammation; and the oldest, a woman, aged sixty-eight, with bilateral cancer of the ovaries.

Myomata and inflammatory disease were found in 79.5 per cent of the specimens examined in the pathologic laboratory. Myomata were present in 164 patients (54.1 per cent). The majority of these growths were

of the multiple variety, in which myomectomy would have been impossible. Davis and Cusick in a questionnaire sent to leading gynecologists in the United States and Canada, received answers which gave an average of 71.6 per cent of all hysterectomies done for the removal of myomata. In their study of 335 patients who were hysterectomized in six different hospitals in Detroit, they found that in 72.16 per cent of cases, the uterus was removed because of the presence of myomata.

As the routine treatment for multiple fibromyomata at the Sinai Hospital is hysterectomy, the lower incidence may be explained on the basis that the hospital has no accommodations for the colored race, and the frequency of myomata in the colored is a well recognized fact.

Malignancy of the uterus was observed in sixteen cases (5.28 per cent). Horwitz in a review of 1237 cases of primary cancer of the uterus at the Mayo Clinic, found only ten in Jewish women. He stated, after comparing the number of hospital admissions of Jewish and non-Jewish patients at the Mayo Clinic, that cancer of the uterus was one-fourth as frequent in Jewish women. The occurrence of cancer of the uterus in 5.28 per cent of our series is in accord with the findings of Davis and Cusick who found in their study 6.09 per cent malignancies. The cervix was involved in five cases, and the fundus in ten cases. This finding is an unusual one, as most of the textbooks teach that cancer of the cervix occurs about eight times as frequently as cancer of the fundus. As three of the patients with cancer of the cervix and two with cancer of the fundus were non-Jewish, our study shows that cancer of the fundus occurred four times as frequently as cancer of the cervix. Whether this indicates a greater immunity to cervical involvement or a greater susceptibility for the fundal site can only be conjectured. Further studies on this subject may yield interesting information.

Table I shows the types of abdominal hysterectomies performed and the pathologic conditions necessitating the operation. Only 27 (8.91 per cent) panhysterectomies were done, of which 50 per cent were per-

TABLE I. TYPE OF OPERATION

DISEASE	NO.	SUBTOTAL HYSTERECTOMY	TOTAL HYSTERECTOMY	PER CENT
Cancer of the Cervix	5	0	5	100
Cancer of the Endometrium	10	3	7	70
Cancer of the Ovary	5	3	2	40
Myoma	164	155	9	5.5
Adenomyoma	12	11	1	8.3
Chronic Pelvic Inflammation	77	75	2	2.5
Fibrosis of the Uterus	9	8	1	11.1
Remaining Conditions	21	21		
Total	303	276-91.09	27	8.91

formed for malignant conditions. In the group of cancer of the endometrium, 3 subtotal hysterectomies were performed for some other condition and the diagnosis was made in the pathologic laboratory. The value of diagnostic curettage is emphasized by this finding, as all these patients complained of vaginal bleeding and curettage would have revealed the true pathology. Only nine (5.5 per cent) complete hysterectomies were performed in the myoma group. The simplicity of the subtotal operation and the increased mortality of the total operation in the hands of the less experienced may explain the low incidence of total hysterectomies in this study. This explanation probably holds also for the 2.5 per cent incidence of total operations for chronic pelvic inflammation.

#### MORTALITY

In this analysis of 303 consecutive abdominal hysterectomies, there were eight deaths, a mortality rate of 2.6 per cent. The subtotal hysterectomies numbered 276, with 7 deaths (2.5 per cent). The total death rate was 3.7 per cent.

The incidence of 2.6 per cent mortality indicates the comparative safety of abdominal hysterectomies and compares very favorably with the results of other Class A hospitals. Davis and Cusick report a mortality percentage of 4.68 in their study and Burch and Burch report a mortality of 7.5 per cent in a series of 200 consecutive hysterectomies at the Vanderbilt University Hospital.

Pulmonary embolism was the direct cause of death of two patients, both of whom had had a hysterectomy performed for multiple myomata. One patient died suddenly on the fifteenth postoperative day after a normal convalescence. Pathologic study of the uterus revealed a sarcoma of the wall. The second patient reacted well from the anesthetic and was considered in excellent condition until the fourth postoperative day, when, while sitting on the bedpan, she dropped over and succumbed within a few minutes.

Two deaths in this series are attributed to shock. One patient, aged forty-one, had a subtotal hysterectomy for chronic pelvic inflammation. She became shocked on the operating table and never fully reacted in spite of vigorous therapy. Pulse and temperature were elevated and death occurred on the third postoperative day. As hemorrhage was not profuse, peritonitis or septicemia may have been the real cause of death. The second patient, aged fifty, had a complete hysterectomy for cancer of the left ovary. She went into shock on the operating table, never reacted completely, and died on the fifth postoperative day. Hemorrhage, during the operative procedure was, no doubt, the important or contributory factor in the production of this so-called surgical shock.

Intestinal obstruction was the cause of the death of one patient. This patient, aged thirty-five, had a subtotal hysterectomy for multiple

myomata; eleven days after operation, a diagnosis of intestinal obstruction was made. Ileostomy was performed, but the patient died twenty-four days later. A loop of ileum adherent to the stump of the cervix was the cause of the obstruction.

One patient succumbed from peritonitis. This patient, aged thirty-two, had a subtotal hysterectomy for multiple myomata. She exhibited the usual picture of general peritonitis and death occurred on the tenth postoperative day.

Acute nephritis with uremia was the cause of death of one patient. This patient had a Porro cesarean section performed for sterilization purposes (having had three previous cesareans for a marked generally contracted pelvis). Forty-eight hours after operation, urine presented the typical findings of acute nephritis; anuria soon followed, then uremia, and death occurred on the fourth postoperative day.

The cause of death of one patient is recorded as myocardial failure. This patient, aged sixty-eight, had had radium for cancer of fundus without checking the uterine hemorrhage. A subtotal hysterectomy was performed and the course was a gradual one to exitus which occurred on the twenty-second postoperative day. This patient was markedly asthenic, and during the postoperative course developed a psychosis which persisted to the end. Although this death is recorded as being due to myocardial failure, the general asthenia and debility of the patient certainly played an important rôle in the result, as this patient was of the type on whom an operation should not have been done.

Fibromyomata. (164 cases—54.12 per cent.)

The age incidence of myomata in this study is in accord with the findings of most clinics. In over 90 per cent of this group, myomata were found between the fourth and sixth decade. From 20 to 30 years, there were found eleven cases (6.6 per cent); from 30 to 40 years, sixty-six cases (40.3 per cent); and from 40 to 50 years, eighty-two cases (50 per cent). Only five (3.2 per cent) myomata were observed in patients over fifty years of age.

The chief complaints of patients in this group, included the usual triad of abnormal uterine bleeding, abdominal pain and tumor of the abdomen. These were present in 90 per cent of the patients. Ninety-four patients (58 per cent) gave a history of abnormal bleeding; of which metrorrhagia occurred as the important symptom in 31.7 per cent and as an associated finding in six patients (3.6 per cent). Menorrhagia occurred as the chief complaint in 9.1 per cent and as an associated finding in twenty-one patients (12.8 per cent). Although abdominal pain was the important complaint in 35.9 per cent of the patients, it was present with varying degrees of intensity in 78 per cent of the patients. Leucorrhea occurred in 28 per cent of the cases.

Cardiac complications constituted the most predominant associated organic derangement found in this group of patients. Sixteen patients

(10 per cent) showed some type of cardiac disease; five with mitral insufficiency; three with mitral stenosis and in eight, cardiac hypertrophy and dilatation was quite marked. This finding suggests that there may be some association of cardiac disease and uterine myomata. Hypertension in seven patients; diabetes mellitus in four patients; and syphilis in two were the only other important constitutional complications of this group.

The preoperative diagnosis of myoma did not cause much difficulty. An error of diagnosis occurred in fifteen cases (9.1 per cent); ovarian cyst in seven cases and salpingitis in four being the chief sources of error.

Subtotal hysterectomy was performed in 155 cases (94.6 per cent) and a total hysterectomy in nine (5.5 per cent). Both ovaries were removed in thirty-three cases (20.1 per cent). Conservation of the ovaries is practiced routinely by the attending surgeons of the Sinai Hospital, and though a 20 per cent extirpation may appear to be too high a percentage for conservatism, further study of this group reveals that 21 patients were over forty-two years of age. Only 7.5 per cent of these patients were young individuals and in most of these patients, the ovaries were removed because of ovarian pathology. Ovarian transplantation was not performed on any castrated patient.

Postoperatively, the following complications were found to have delayed convalescence; pyelitis in four cases; phlebitis in six, and pulmonary embolism in three. Pulmonary embolism was attended with a high mortality, two of the patients succumbing. Although pulmonary embolism was diagnosed in only three cases, it is probable that it occurred with greater frequency, but as there were no alarming symptoms, the condition passed unrecognized. Suppuration of the wound occurred in fifteen cases (9.1 per cent) and of the nine total hysterectomies performed in this series, three patients developed infection of the wound.

The growths varied in size from 1 cm. to 25 cm. in diameter and were multiple in all but eleven. These eleven uteri presented submucous growth which so distorted the size and shape of the uterus, that hysterectomy was the only possible procedure. Degenerative changes were present in 42 per cent of the myomata of which hyalinization and calcification were the most frequently noted. Liquefaction was present in two myomata; red degeneration in three, and five showed marked infection. Although sections are taken routinely, from the different growths, and also from any suspicious looking area, no evidence of malignant degeneration was found in any of the myomata.

Microscopically, hyperplasia of the endometrium was observed in fifty cases (30.5 per cent); forty-two of these patients (84 per cent) presented clinically some type of abnormal uterine bleeding. What factor hyperplasia played in the production of this bleeding can only



be conjectured, but in growths other than submucous or endometrial polyp, its importance cannot be overlooked.

Adenomyoma of the uterine wall was noted in sections from fifty-eight uteri (35.3 per cent). In this pathologic classification were placed all sections showing invasion of the myometrium by uterine glands and stroma. Sections from most of these uteri showed a typical microscopic picture of adenomyoma, but included in this grouping there were some atypical sections, which showed only two or three glands scattered in the superficial layer of the myometrium, unassociated with endometrial stroma. These we recognize as potential adenomyomas and were classified under the diagnosis of adenomyoma. Thirty-eight (65.5 per cent) of these patients had abnormal uterine bleeding (the rôle adenomyoma played in the causation of the bleeding cannot be explained).

Decidual tissue was observed in eight uteri (4.9 per cent). In these cases, pregnancy was entirely unsuspected preoperatively by the operating surgeon and no doubt, had this condition been recognized, operative work would have been postponed.

Sections from seven uteri (4.3 per cent) showed chronic metritis. In these cases, there was an associated chronic pelvic inflammation, which is evidence of the inadequacy of conservation of the uterus in inflammatory disease of the adnexae.

#### ADENOMYOMA

True adenomyoma was observed in twelve patients (3.96 per cent) of this series. All of these patients were married and multiparous with one exception. Adenomyoma was present seven times in the fifth decade, and four times in the fourth decade. The diagnosis of adenomyoma cannot be made preoperatively with any degree of certainty. The most frequent error in the diagnosis is with myoma. In this analysis, fibromyoma was the clinical diagnosis in six cases (50 per cent) and in the other cases, the preoperative diagnosis was distributed over six different pathologic conditions. Abnormal uterine bleeding was the chief complaint of nine patients (75 per cent); metrorrhagia being present in eight and menorrhagia in one patient. Abdominal pain was the chief complaint of two patients, and was present in four other patients.

Subtotal hysterectomy was done eleven times and total hysterectomy once. Bilateral oophorectomy was done on two patients (16.6 per cent) as both of these women were over forty years of age.

Pathologically, eight uteri showed grossly the typical picture of adenomyoma. The uteri were enlarged to the left and posteriorly, and varied in size from eight to twelve centimeters. Minute hemorrhagic areas were seen scattered irregularly throughout the growths. The margins of the tumor and the uterine wall could not be discerned because of the diffuseness of the growth. The opposite uterine wall

showed marked thickening measuring as much as 5 cm. in diameter at the midfundal level. The blood vessels in the uterine wall were very prominent and there were numerous areas of connective tissue interlacing the musculature. Microscopically, the growths showed many areas of endometrial glands and stroma, many of the glands were hyperplastic and filled with blood. Infection of the wall was observed in only one case.

#### CHRONIC PELVIC INFLAMMATION

In this classification were placed all cases of salpingitis of pyogenic and gonorrheal origin. There were 77 cases (25.41 per cent) in this analysis. Whereas newgrowths of the pelvic organs are the most frequent pathologic conditions in elderly women, the antithesis in the young is salpingitis.

Three patients were in their teens; 43 (60 per cent) were in their twenties; 25 (32.4 per cent) in the thirties and only 6 (7.8 per cent) were over forty years of age. Abdominal pain was the chief complaint of 65 patients (84.4 per cent). Of these, 20 (26 per cent) gave a history of abnormal uterine bleeding, menorrhagia occurring in 15, and metrorrhagia in 5 patients. As the chief complaint, abnormal uterine bleeding was present in 10 (13 per cent). Severe arthritis was the predominant complaint of 2 patients. It is interesting to note that 39 per cent of the patients in this group presented abnormal uterine bleeding—a finding which is in accord with the accepted belief of the occurrence of menorrhagia and metrorrhagia in chronic pelvic inflammation. Leucorrhea was a constant symptom in every case, and stained smears were positive for the gonococci in 8 cases (10.3 per cent). Syphilis was diagnosed serologically in 9 (11.7 per cent) of the patients. This is a significant finding, for the occurrence of syphilis in the average run of patients of this hospital is less than 4 per cent.

The clinical diagnosis in this group offered no difficulty. In 73 cases (94.8 per cent) the preoperative diagnosis was confirmed by operation and by pathologic examination. In 4 cases, chronic appendicitis and cystic ovaries were the incorrect diagnosis made on two occasions. Although 9 patients were admitted to the hospital with a tentative diagnosis of acute appendicitis, expectant treatment determined the true nature of the disease within a short period of time.

Subtotal hysterectomy was performed on 75 patients (97.5 per cent) and total hysterectomy on 2. Both ovaries were excised in 53 cases (68.8 per cent) and 21 (27.2 per cent) had a unilateral oophorectomy performed. Of these 21 patients, 14 gave a history of having had both tubes and an ovary removed at a previous laparotomy for chronic pelvic inflammation. The lapse of time from the first operation varied from eight months to nine years; the ovarian tissue was conserved at that time because of the youth of the patient. Hence, the total number

of patients in this group in whom castration was performed at the time of operation was 67 (87 per cent). Although this figure may appear unusually high and may denote radical ovarian surgery, the following explanations must be taken into consideration:

1. That in over 60 per cent of these cases, chronic inflammation had produced such irreparable damage that conservative measures were out of the question.

2. That many of these patients were wage earners and to suffer another economic loss from a possible second operation for the removal of a degenerated ovary excluded ovarian conservation.

Postoperative complications. Bronchopneumonia occurred in three patients; ether was the anesthetic used. Pelvic abscess developed in two patients and a posterior colpotomy was necessary. Pyelitis was a complication in two cases and phlebitis in two cases. Suppuration of the wound occurred 17 times (23.2 per cent). This can be explained on the basis of direct contamination from the escape of pus in the removal of the tube or ovary during operative manipulation. These cases were drained vaginally. Abdominal drainage was done once in this series.

Grossly, fibromyomata were found in 9 uteri. These were small subserous or intramural growths. Two tubes were microscopically the seat of an extrauterine pregnancy. Pyosalpinx, unilateral or bilateral, was observed in 12 specimens. Tuboovarian abscess was noted 8 times and hydrosalpinx 11 times. Microscopically, infection of the uterus was a constant finding. Sixty uteri (78 per cent) showed definite infection of the endometrium. This infection varied in intensity in different uteri, some showed only a moderate increase in round cell infiltration; while in others, there were seen in the endometrium extensive areas of round cell infiltration, changes in the stromal cells and destruction of the glands. Infection of the endometrium was found associated with infection of the wall in almost every uterus. Chronic metritis was observed in 57 uteri (74 per cent). These findings certainly tend to corroborate the opinion of some gynecologists, who claim that radical uterine surgery is a necessity for an absolute cure of chronic pelvic inflammation.

#### TUBERCULOUS SALPINGITIS

One case of tuberculous salpingitis (0.3 per cent of the total series) was noted in this review. The finding of 1.2 per cent corresponds with the general incidence of tuberculous salpingitis. Greenberg in his analysis at Johns Hopkins University found tuberculous salpingitis occurred in 1 per cent of all cases of salpingitis. In this case, there were found at operation and from section, the typical lesions of tuberculous involvement of the tubes.

## METRITIS

Four cases (1.3 per cent of the total series) showed a marked degree of infection of the uterus. Two patients who were in the third decade of life had had a previous conservative operation for chronic pelvic inflammation. One of these patients, aged twenty-nine, had been operated upon three years previously, at which time both tubes and one ovary had been removed. Abdominal pain occurred nine months later and a second operation was necessary. The other patient, aged twenty-seven, had been operated upon one year before, at which time a bilateral salpingectomy was done. Eight weeks before the second operation, the patient developed a gonorrheal arthritis and a laparotomy was performed removing the uterus and ovaries, the foci of infection. The remaining two patients, both in the fifth decade of life, had a subtotal hysterectomy performed because of severe metrorrhagia. No gross pathologic lesions could be demonstrated but microscopically, extensive infection of the endometrium and uterine wall was quite marked.

## MALIGNANCY OF THE UTERUS

Sixteen uteri (5.28 per cent) in this analysis were the seat of malignant changes. The cervix was involved in 5 cases (1.65 per cent), the endometrium in 10 (3.3 per cent) and in one uterus, sarcoma was found in the uterine wall.

## CANCER OF THE CERVIX

All 5 patients were between forty-one and forty-eight years of age, were married, and multiparae. Two patients had passed the menopause three and a half and two years, respectively. Vaginal bleeding appeared in one five months, and the other three weeks before operation. All of the patients complained of metrorrhagia, the duration of which varied from one week in one patient to nine months in another. In 3 cases, the condition was recognized clinically and in 2 cases, the diagnosis was made in the pathologic laboratory. These 2 patients were hysterectomized because of multiple myomata and as suspicious ulceration of the cervix was noted, a total operation was performed. The sagacity of this procedure was substantiated by the finding of malignancy on routine histopathologic study. Panhysterectomy was performed on all the patients under general anesthesia. Postoperative pneumonia delayed the convalescence of one patient and wound suppuration occurred in three cases. The frequent occurrence of infection of the wound in cases having a total hysterectomy performed has been a consistent finding in this study, and can only be explained on the basis of direct contamination from the vagina. There were no mortalities in this group during the hospital stay, but all of the patients were dead within eighteen months following the operation. Of the five cases, three were considered

inoperable and two definitely operable. One of the three inoperable cases had a thorough cauterization of the cervix with the Percy cautery and several weeks later, the local involvement had so improved as to permit a panhysterectomy to be done. Pathologically, canliflower growths were present in three cases and two cervixes exhibited an indurated ulceration well localized and without involvement of the parametrium. Microscopically, all were squamous cell cancers, no cellular classification was made.

#### ADENOCARCINOMA OF THE FUNDUS UTERI

Ten uteri in this study were the seat of malignant changes in the fundus. These uteri were removed from patients all of whom were married and had given birth to one or more children; eight were Jewish and two non-Jewish. The ages were widely distributed from thirty-seven to sixty-eight years; 2 being in the late thirties; 3 in the late forties; 3 in the early fifties and 2 in the seventh decade of life. Nine of these patients presented metrorrhagia as the chief complaint and one patient who showed no menstrual disturbance came to operation because of severe abdominal pain. Seven patients were past the menopause, for periods varying from four months to twenty years and it is interesting that 3 of these patients who were postelimeric four months to two years, complained of vaginal bleeding of only three to six weeks' duration, whereas 4 patients who were postelimeric ten to twenty years, complained of vaginal bleeding of four months' to one year's duration. The importance of educating women who have passed the climacteric period of life to seek medical advice without delay upon the reappearance of vaginal bleeding or spotting cannot be too strongly urged.

Diagnostic curettage was performed on 4 patients. Two were subjected to hysterectomy with the clinical diagnosis of adenocarcinoma, and in 3 cases, the malignancy was not suspected and was recognized in the pathologic laboratory. In one patient, because of ulceration of the cervix, the preoperative diagnosis of cancer of the cervix was made. Panhysterectomy was performed 7 times and the subtotal operation 3 times. In these 3 patients, the clinical diagnosis was myoma, and as malignancy was not suspected, an incomplete operation was done. Grossly, these uteri showed unmistakable evidence of cancer of the fundus. Examination of the opened uterus after excision at the operating table would have revealed the true pathologic lesion, and the complete operation done. Incision of the uterus and examination of the endometrium at the table following a subtotal hysterectomy should be the routine of every surgeon. Only when this will be done routinely will unsuspected malignant changes of the fundus come to light and incomplete operations be averted. Spinal anesthesia was used in one case complicated by diabetes mellitus, and avertin and ether in one case of

chronic myocarditis. Infection of the wound occurred in three cases in which total hysterectomy was done.

Pathologically, four uteri contained intramural and subserous fibromyomata. Grossly 9 uteri showed changes in the endometrium which were easily recognizable as being malignant. In 5, the uterine cavity was a mass of necrotic, villous, decomposing tissue and in 4, the endometrium was hypertrophied, polypoid, friable, and spongy. In one uterus, there were no gross changes of cancer visible. This case, microscopically, showed a very early adenocarcinoma of the endometrium; so early a change as to suggest cure by curettage operation, several of such instances having been recently reported in literature.

#### SARCOMA OF THE UTERUS

In this analysis, one uterus was removed because of multiple myomata. These growths were subserous and intramural in variety and all were benign to gross and microscopic examination. However, in the left fundal wall unassociated with any fibromyomatous growth was observed an ulcerated growth of about 2 cm. in diameter which on histopathologic examination showed definite sarcomatous changes. This was apparently a true primary sarcoma arising primarily from the connective tissue of the myometrium.

#### MALIGNANCY OF THE OVARIES

Malignancy of the ovaries was noted 5 times (1.65 per cent) in this study. Three were primary adenocarcinomata and 2 were papillary serous cystadenomata with malignant changes. The three patients with cancer of the ovaries were married and multiparae. They had passed the menopause for a period of from one and a half to twelve years and were fifty, fifty-three and sixty-three years of age, respectively. Vaginal bleeding was the chief complaint and had been present from three days in one patient to seventeen months in another. Cancer of the ovaries was suspected in two cases and cancer of the fundus in the third patient. Panhysterectomy was performed on two patients and subtotal hysterectomy with intestinal resection on the third. Wound suppuration occurred in both patients having a total hysterectomy. Postoperative pneumonia occurred in one case and vesicovaginal fistula was a complication in another.

Pathologically, these three cases presented the usual gross findings of cancer which was substantiated by microscopic study.

Papillary serous cystadenoma with malignant changes, on the contrary, was noted in young individuals. The patients were twenty-four and thirty-five years of age; were married and had given birth to one or more children. One patient had had an exploratory operation six years previous at which time extensive metastases were found involving the omentum, intestines, and peritoneum. Only enough tissue for patho-

logic study was removed at that time as the disease was considered inoperable. At a second operation, the growth was found well localized in the pelvis with no evidence of metastases to the abdominal viscera. The uterus and ovaries were removed and histopathologic examination revealed that cancer was still present, but extensive calcification had taken place. This patient is alive and well eleven years after the first operation. The second patient was laparotomized for an abdominal tumor. Subtotal hysterectomy with bilateral oophorectomy was done; patient's recovery was delayed by a postoperative pneumonia. Examination of the ovarian cysts revealed grossly a papillary serous cystadenoma which on microscopic study showed malignant changes.

#### FIBROSIS OF THE UTERUS

Nine uteri (2.98 per cent) in this series were classified as definite cases of fibrosis. Pathologically all these uteri presented gross characteristic changes in the uterine wall. No other pathologic condition was observed. All the uteri were enlarged; the walls considerably thickened and measuring as much as 6 cm. across at the midfundal level. All showed numerous sclerotic vessels standing out distinctly in the walls and extensive areas of connective tissue could be seen scattered throughout. Microscopically, the uterine walls showed marked areas of fibrosis and in many places, the myometrium had been entirely replaced by connective tissue. Advanced arteriosclerosis of the blood vessels was a characteristic finding.

All these patients were married and multiparae, seven were between thirty-five and forty-nine years of age. Abnormal uterine bleeding was the chief complaint of six patients and menorrhagia was present in two other cases. In only two cases was the true condition suspected. The preoperative diagnosis in three cases was myoma; in two, ovarian cyst; and in two, abdominal adhesions. Subtotal hysterectomy was performed eight times and total once. Bilateral oophorectomy was performed on three patients because they were at the menopausal age. Pulmonary embolism with recovery complicated the convalescence of one patient and wound suppuration occurred in three other cases.

#### HYPERPLASIA OF THE ENDOMETRIUM

There were two patients in this analysis on whom a hysterectomy was performed for vaginal bleeding. The only pathologic finding was a hyperplasia of the endometrium. These patients were forty-two and forty-six years of age, and both had had a diagnostic curettage performed a short time previous to the laparotomy. Histopathologic examination of the uterine scrapings revealed a typical Swiss cheese pattern of hyperplasia of the endometrium. Bleeding recurred soon after the curettage, and during a period of observation, the bleeding became more profuse and a subtotal hysterectomy was performed. Pathologic

examination of these two uteri showed a marked hypertrophy of the endometrium, as the only abnormal findings, and on microscopic study, the same picture was noted as in examination of the scrapings. Why these patients were not treated with deep x-ray could not be ascertained.

Normal: Eight uteri (2.6 per cent) exhibited no pathologic findings either in the uterus or the adnexa. Two patients in the group were single and four were under thirty-five years of age. Abnormal bleeding from the uterus was the chief complaint of three patients; abdominal pain of two patients, leucorrhea of one, nervousness of one, and prolapse of one. The preoperative diagnosis varied in these cases covering almost the entire field of gynecologic diseases. Subtotal hysterectomy was performed in all eight cases, and one patient near the menopausal age, had both ovaries excised. These cases should be dismissed with comment as being the result of the errors of human imperfection.

#### PORRO CESAREAN SECTION

Four Porro cesarean sections were observed in this study. All the patients were multiparae and between twenty-seven and forty-four years of age. The indications for the operation were as follows:

Case I—Generally contracted pelvis—three stillbirths due to difficult forceps operation and three cesarean sections.

Case II—Pelvic deformity—two previous cesarean sections.

Case III—Multiple fibroids in a patient forty-four years of age.

Case IV—Feeble-mindedness.

One death occurred in this group giving a mortality of 25 per cent for this type of operative procedure.

There was one case of accidental perforation of the uterus in this series. This patient had a curettage operation performed at her home. The uterus was perforated and the omentum was found in the vagina. Immediate laparotomy revealed a uterus so irreparably damaged that a subtotal hysterectomy was the only possible procedure. Histopathologic examination of the uterine wall and omentum showed marked evidence of infection.

#### SUMMARY

1. A series of 303 consecutive abdominal hysterectomies for a variety of pathologic conditions is reported with a mortality of 2.6 per cent.
2. Approximately 85 per cent of the uteri were removed for myomata, chronic pelvic inflammation and malignancies, and the important symptoms necessitating surgical aid were pain, bleeding, and tumor.
3. Cancer of the fundus of the uterus in this series occurs four times as often as cancer of the cervix.
4. Statistical reviews of major surgical operations at periodic intervals will reveal many interesting facts and tend to increase the efficiency of the surgical departments of hospitals.



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1928 EUTAW PLACE.

## DO SPERM MORPHOLOGY AND BIOMETRICS REALLY OFFER A RELIABLE INDEX OF FERTILITY?

G. L. MOENCH, M.D., NEW YORK, N. Y.

IT IS not very unusual to see a clinically sterile couple in whom the woman shows no discoverable anomaly and the husband has actively motile sperms. I have pointed out in previous papers<sup>1, 2</sup> that the presence of actively motile sperms does not constitute proof of the man's fertility and that not a few apparently unsolved cases of disturbed fertility can be explained by a complete morphologic and biometric examination of the spermatozoa, especially of their heads.

From the 141 cases previously reported upon I drew the following tentative conclusions:

1. A normally fertile man always ejaculates less than 20 per cent abnormal sperm heads.
2. If the head abnormalities rise to between 20 and 25 per cent impaired fertility is to be assumed and above 25 per cent there is always sterility.
3. The graph constructed from 300 or more sperm head lengths in normal cases seldom shows a coefficient of variability above 11.
4. With a coefficient of variability between 11.5 and 12.5 impaired fertility is present and above 12.5 sterility.
5. A graph which shows a skewness of 4 times the probable error or more always indicates disturbed fertility because such a graph can only be the result of either too many disproportionately large, or disproportionately small sperm heads.

I now have 89 additional cases (making a total of 230) to report upon. Of these 89 cases, 5 represented normally fertile couples. The coefficients of variability of these 5 cases fitted very well into our previous normal group (see Fig. 1). Of the remaining 84 couples, 63 had never had children; 8 had 1 or 2 children and wanted more; and 12 had had abortions but no living children. In one case a doubtful abortion occurred. The husbands in the case of the childless couples had no spermatozoa at all in 9 cases (3 times after mumps around puberty with testicular atrophy, 5 times after gonorrhea and once unexplained). Twenty-seven men had more than 25 per cent abnormal sperm heads; 4 between 20 and 25 per cent, and one, whose semen only showed 18 per cent abnormal sperm heads, had 11.5 per cent narrow and tapering

sperm heads. Twenty-four men had normal seminal findings (13 to 18 per cent abnormal sperm heads and a coefficient of variability between 8.4 and 11.2). The women in this group were 23 times at least not quite normal (closed tubes, hypoplasia uteri, cervicitis, endocrine dysfunction, etc.). Some of the disturbances were, however, not marked so that 7 pregnancies occurred in this group. One woman, still sterile, was apparently normal, so that the infertility is still unexplained here. All told there were 32 abnormal women among the 63 couples where the wife

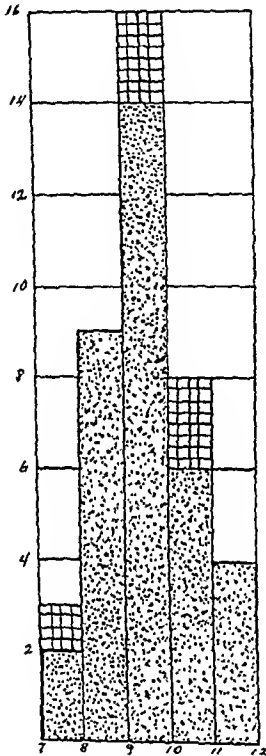


Fig. 1.

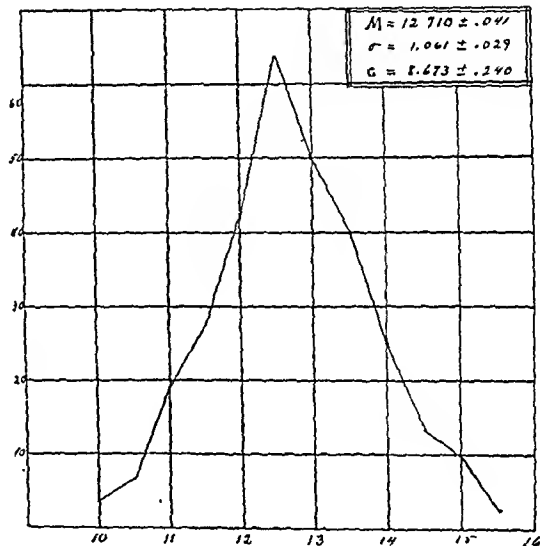


Fig. 2.

Fig. 1.—Histogram made up of the coefficients of variability of the normal cases, using only the whole numbers and disregarding the fractions. The stippled areas are the previously reported cases, the cross hatched areas the 5 new ones. The numbers on the vertical line show the number of cases, those on the horizontal line the value of the coefficients of variability.

Fig. 2.—Graph made up from 300 sperm head lengths (measured in half and whole mm. at 3000 diameter magnification). The wife of this man had a cervicitis and became pregnant as soon as this was cleared up. Numbers on the vertical show the number of sperm heads of a particular size, numbers on the horizontal the size of the sperm heads in mm. at 3000 diameter magnification.

had never become pregnant. In 3 cases the woman had closed fallopian tubes and the man no spermatozoa at all following gonorrheal occlusion of the vasa deferentia.

To show the importance of a careful examination of the semen I have placed side by side the abstracts and seminal findings of two *clinically* apparently similar cases:

CASE 1.—J. M., white woman, twenty-four years old, married 2 years, never pregnant, no contraceptives ever used. The physical examination showed no abnormalities

except a marked cervicitis. The husband was thirty years old and physically normal. The semen contained many actively motile spermatozoa. Head abnormalities were only 13 per cent and the coefficient of variability was  $8.673 \pm .240$  (see Fig. 2). After the cervicitis was cleared up the wife promptly became pregnant.

CASE 2.—E. F., white woman, twenty-six years old, married three years, never pregnant, no contraceptives used. The only physical abnormality was a marked cervicitis. The husband was physically normal, twenty-nine years old. The semen contained many actively motile spermatozoa, but there were 28 per cent abnormal head forms present and the coefficient of variability was  $12.600 \pm .352$  (see Fig. 3). Although the cervicitis was cleared up, pregnancy did not occur and has not up to now, two years later. An artificial impregnation carried out by another gynecologist was also ineffective.

In the 8 couples who had had children but wanted more, the husband was over fifty years old in 4 instances and close to fifty in 2 others. Apparently a diminution of the fertility had set in in these cases purely on

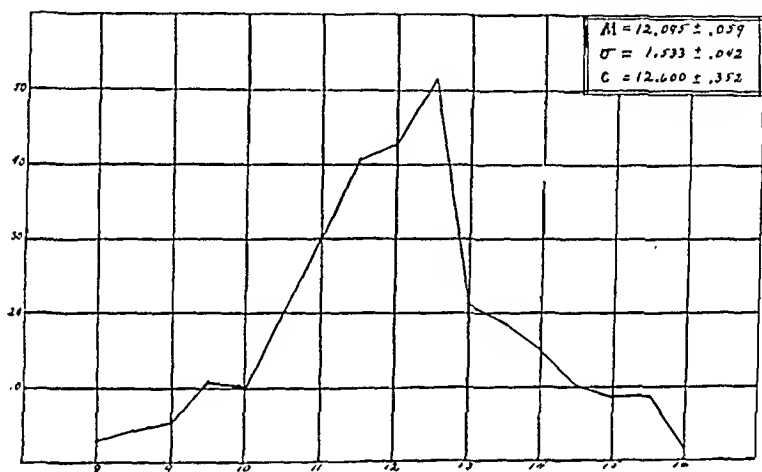


Fig. 3.—Same type of graph as Fig. 2 made up likewise from 300 sperm head lengths. Notice the skewness present here. The wife here too had a cervicitis but she did not conceive even after the lesion was cleared up. See also text.

the basis of age. The head abnormalities in these cases were always abundant, between 21 and 31 per cent. One woman of this group had closed tubes at the time of the examination apparently after an induced abortion and one had grown very stout and was an evident case of endocrine dysfunction.

In the 13 couples who had had no children but where the wife had had one or more abortions, the woman had closed tubes 5 times after induced abortion and the husbands showed between 20 and 25 per cent abnormal sperm heads in 6 cases. In 2 cases no cause at all could be found for the spontaneous abortions which the woman had had. Thus among 84 cases the man was apparently normal in 33 and the woman in 44. These figures are, however, not to be taken as generally applicable because our cases were not random samples but more or less picked. Thus very often a man was sent to me only because the sterility in the particular case was not explained. I think it is worth while to emphasize that 7 out of

10 women, whose husbands had between 20 and 25 per cent abnormal sperm heads, had had spontaneous abortions.

The findings in these additional 89 cases thus seem to corroborate in every way the tentative conclusions which were drawn from the previously investigated 141 cases so that I really believe, we may say that a morphologic and biometric examination of the semen offers a method for discovering disturbed male fertility.

In interpreting the seminal findings one must, however, not forget that seminal morphology and biometrics do not necessarily run parallel for reasons already stated (Moench, l. c.). Thus neither a normal morphology alone nor a normal biometric result alone means that the semen is normal. On the other hand a disturbance in *either* one of these 2 factors means disturbed spermatogenesis and thus impaired fertility. A marked skewness also indicates the same thing.

It may seem improbable to some of my readers that such a relatively small percentage of abnormal heads can have any influence on fertility. I believe, however, that the correct interpretation of my findings is that the number of abnormal sperm heads indicates the degree of the spermatogenic disturbance and that the other sperm heads although they may appear normal to our rather crude microscope, are not normal when the disturbance of the spermatogenesis reaches certain high levels.

Perhaps this explanation may still not satisfy some of the skeptics. They perhaps cannot believe that such minute details of seminal examination can really constitute an indicator for male fertility. Here I can only answer that among all our cases there was not a single one in which the clinical outcome of the marriage contradicted the prognosis which we had made purely on the basis of the microscopic findings. Thus the wives of a number of men whom we declared normal, became pregnant later on, but not a single woman, whose husband we found sterile according to the standards outlined here, became pregnant as long as the disturbance of the spermatogenesis persisted. There were also many cases which had been considered unexplained before which almost explained themselves when the results of the semen examination were taken into consideration.

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30 EAST 58TH STREET.

## VESICoureTERAL REFLUX AS AN ETIOLOGIC FACTOR IN PYELITIS OF PREGNANCY

HAROLD L. MORRIS, M.D., F.A.C.S., AND JAMES F. BRUNTON, M.D.,  
DETROIT, MICH.

DURING the past twenty years numerous investigations have been carried out in an attempt to definitely determine the true etiology of pyelitis of pregnancy. At this time no definite factor or factors have been agreed upon, but the results of the various investigations have added considerably to our knowledge of the frequency, pathology, and treatment of this condition.

Two modes of infection of the renal pelvis are described by nearly every writer on this topic: (1) hematogenous, and (2) lymphogenous. The question as to whether there is an ascending infection by way of the lumen of the ureter and a resultant infection has been reopened recently by Barksdale.<sup>1</sup>

The views of many writers that this type of renal infection is secondary is significant. The original focus of infection may be in the upper respiratory tract, teeth, tonsils, sinuses or gastrointestinal system, the organism gaining entrance to the kidneys by the circulatory or lymphogenous routes. McComb<sup>2</sup> mentions the ascending lymphogenous route in cases of pregnant women with cystocele, residual urine, and bladder infection.

Since the bacteriologic findings indicate that in the majority of cases *Bacillus coli* is the offending organism, the gastrointestinal system is looked upon as the original cause of this condition. Constipation is common among these women, although many are loath to admit it. One daily bowel movement is not evidence that constipation does not exist; the rectum may not be completely emptied at each defecation. Franke and Stahr, as quoted by Shields,<sup>3</sup> have shown that the lymphatics of the large bowel on the right side pass over the capsule of the right kidney, and that the deep lymphatics of the kidney communicate with those of the capsule, which may substantiate the theory of direct invasion of the kidney from the large bowel by way of these lymphatics.

The question of uterine pressure upon the ureters at the pelvic brim seems to be totally discounted by the majority of recent contributors. They do not however, waive the factor of uterine compression in the pelvis. Carson<sup>4</sup> reports 16 cases of pregnancy which came to autopsy, and in each case the enlarged uterus was seen to press directly upon the right ureter, and that from this point upward the ureter was definitely dilated. He contends that the sigmoid flexure of the colon seems to protect the left ureter to some extent. When the uterus was lifted out, the pelvic portion of the ureter was seen to fill. Apparently there are still some adherents to the view that mechanical pressure is an etiologic factor in pyelitis of pregnancy, quoting the dextrorotation of the pregnant uterus as an additional factor.

We are indebted to Duncan and Seng<sup>5</sup> for a detailed and comprehensive study of the urinary tract during pregnancy. In their investigation of 78 cases, they have reported finding a general engorgement and congestion of the urethra, and bladder mucosa; and a congestion, lengthening of the diameters and elevation of the inter-ureteric ridge of the trigone, all these occurring as early as the eighth week. They could not demonstrate any changes in the ureteral orifices.

Dilatation of the ureters has been investigated by a number of authors, notably Hofbauer,<sup>6</sup> Duncan and Seng, Baird,<sup>7</sup> Crabtree,<sup>8</sup> and others.

Very few writers mentioned the question of stasis due to renal dystopia. Pugh<sup>9</sup> cites this as a predisposing factor. Stevens and Henderson<sup>10</sup> mentioned the fact that four-fifths of the cases of renal dystopia occur in women. In our own investigations<sup>11</sup> we know that renal dystopia occurs on the right side in 32 per cent of all investigated cases; that the majority of these cases, even while not pregnant, harbor infection in the renal pelvis; and that women are more prone to renal dystopia than men, irrespective of age and weight. We consider that stasis could easily be an important etiologic factor in pyelitis of pregnancy, and perhaps a very important one.

The recent clinical and pathologic findings of a number of writers have turned the attention of those interested in this question to the changes in the ureteral wall during pregnancy. Papin<sup>12</sup> reports Jolly's findings of ureteral dilatation in 12 to 15 per cent of cases of pregnancy. The right ureter being involved more often than the left, and if there is involvement of both, the right shows the greatest amount of dilatation. Duncan and Seng have confirmed these findings, and also state that it is demonstrable as early as the sixth week in multiparae, and the tenth week in primiparae. This condition reaches its maximum during the twenty-fourth week in primiparae and the twenty-second week in multiparae. The right ureter showed some dilatation in every one of their 78 cases. Bilateral dilatation was more common in multiparae. They were also impressed with the fact that the ureter, like the perineum, involutes to a normal but relaxed state, and that there is some degree of dilatation long after the rest of the tissues had resumed normal. Ureteral distortions were found as early as the sixteenth week and more frequently in the antepartum cases. Marked hydronephrosis was found more frequently in multiparae. They consider stasis to be an important factor in the development of pyelitis. In their cases the left pelvis emptied itself in the normal limit of seven minutes. In the delayed cases the right side outnumbered the left in the proportion of four to three. Ureteral dilatation and hydronephrosis appear and reach their maximum early in pregnancy. Stasis however, does not appear until the twentieth week. They agree with Carson that pressure at the pelvic brim is responsible for the dilatation of the ureter, and that stasis was relieved after the delivery of the child.

An increase in the amount of connective tissue and muscle fibers has been demonstrated by them; a moderate amount in the upper third; a less amount in the middle third; and a marked increase in the lower third. They believe that this hyperplasia is a protective measure against regurgitation and only becomes pathologic when the musculature becomes atonic.

Baird, reporting the results of his investigation of 1000 cases of pregnancy admitted to the Glasgow Royal Maternity and Women's Hospital, found 429 urinary tract infections, and 163 of these with pyelitis. He agrees with Duncan and Seng that the hyperplasia occurring in the ureteral wall is a protective mechanism to increase the tonicity of the ureter and overcome dilatation.

Hofbauer discounts the compression theory since many cases of pyelitis occur in the early months of pregnancy when the uterus has not attained sufficient size to be a factor, and he also considers the theory to be incompatible since the specific

gravity of the pregnant uterus is the same as that of the other abdominal organs (DeLee). He has described in great detail the pathologic findings in the ureters during pregnancy which consists of definite hyperplasia and hypertrophic changes in the lower third and juxta vesical ureter where it passes through the parametrium, and has found that similar changes occur in the trigone. Such changes are less marked in the abdominal ureter. He also states that the mucosa of the ureter shows thickening due to edema. The changes noted in the ureters are also found in the interureteric ridge of the trigone. The striated muscle of the vesical neck and proximal portion of the urethra are definitely increased. As a result of these changes there is a tendency for the lower portion of the ureter and trigone to become a dense unyielding structure, and a definite band is formed beyond the trigone resulting in residual urine and stasis. Pemberton in discussing Hofbauer's paper considers that if this explanation is the fundamental one then pyelitis should be more frequently bilateral.

We have considered it necessary to review the current literature on the etiology of pyelitis of pregnancy before presenting our own findings, in order that a complete understanding of the whole phase of the subject might be more clear.

The problem we outlined for ourselves was to determine as far as possible whether the theory of ascending infection to the renal pelvis by way of the lumen of the ureter was tenable, and if so to what extent it is a factor in pyelitis of pregnancy. Our investigation was prompted by a recent article by Barksdale, in which he demonstrated the phenomenon of reflux in 83 per cent of pregnant dogs. This means of ascending infection has been considered for some time since Young<sup>13</sup> in 1898 attempted to demonstrate reflux, but without success. Eisenrath<sup>14</sup> reported that reflux did not occur in his series of 41 cases of pregnancy. Bumpus,<sup>15</sup> at the Mayo Clinic, demonstrated 89 cases of reflux in a series of 1036 cystograms, and concluded that reflux was never found in the normal bladder except in children. Kretschmer<sup>16</sup> reports the finding of reflux in children under anesthesia.

There is a difference of opinion as to the causation of reflux. That it may be due to a congenital inability of the lower end of the ureter to oppose the reflux when the bladder contracts is admitted, but this would be applicable in only a very few cases.

There are other groups of cases where reflux has been demonstrated: (1) severe acute cystitis, (2) chronic nontuberculous infections of the entire urinary tract, (3) genitourinary tuberculosis, (4) mechanical obstruction at the bladder outlet, (5) cases of neurologic origin (spinal injuries, myelitis, spinal syphilis), and (6) pernicious anemia.

Papin has been able to demonstrate reflux by a slow filling of the bladder in apparently normal individuals, which might support the theory that reflux can occur by a hypertonic contraction of the bladder wall on its contents, and thus permit the opening of the ureteral orifices and reflux to occur. If an acute or chronic inflammatory change in the vesical or ureteral wall interferes with proper closure of the ureteral orifices, ascent of the bladder content can be expected, but one could hardly term this a reflux; more properly regurgitation, since it implies a gaping

ureteral opening and lack of complete physiologic function of the intraparietal ureter.

Satani<sup>11</sup> following animal experimentation has stated that there is normally no reflux into the ureter, and that prevention of reflux is referable to a physical and physiologic activity: (1) the distended muscle fibers over the ureter tend to press the ureter together, (2) a layer of longitudinal muscle is found on the outer side of the intraparietal part of the ureter, and (3) Waldeyer's sheath covers the medial side of the small section just above the intraparietal part. The contraction of the outer fibers tends to close the orifice, and contraction of Waldeyer's sheath causes the lip-shaped upper rim to protrude.

During the past five months we have conducted a clinical investigation in 104 cases of pregnancy in the third trimester, with a view to ascertaining the frequency and significance of vesicoureteral reflux. Cases in the third trimester only were selected; as we considered that the maximum effects of uterine pressure would be apparent in that period, if uterine pressure could be a factor in the etiology of pyelitis during pregnancy.

Catheterized specimens were taken in every case, for the purpose of obtaining routine chemical urinalysis, cell counts, and cultures. Every care was taken to observe a strict aseptic technic. The bladder was slowly filled and 30 c.c. of 15 per cent sodium iodide added. No attempt was made to distend the bladder to the point of discomfort, as we did not wish to set up bladder spasm by distention. Each patient was placed in exaggerated Trendelenberg position for ten minutes, and at the end of that time cystograms were taken on a 14 by 17 film.

In the whole series of 104 cases the phenomenon of ureteral reflux could only be demonstrated in two:

CASE 1.—There were no symptoms referable to the genitourinary system. Urinalysis, culture and cell counts did not reveal any evidence of infection. The reflux was bilateral and confined to the lower third of the ureters. It was noted at the time that this patient had voided some of the contents of the bladder during the ten-minute period and before the cystogram was taken. This case may be either a congenital one, or as mentioned previously, as having a hypertonic contraction with reflux. Cystoscopy after term showed bilateral elevated and gaping ureters, but no evidence of infection was obtained. Repeated attempts have been made to have this patient return for further check up by means of pyelograms, but without success. She was a para i, aged twenty-nine.

CASE 2.—This woman had no genitourinary tract complaints beyond that of backache, and slight frequency of urination which she attributed to the pressure of the uterus. She was returned to the urologic department after demonstration of right ureteral reflux, and a large amount of pus in the urine. Treatment was instituted and an attempt was made to demonstrate any abnormality of the genitourinary tract by means of intravenous skiodan but without success. Improvement was noted antepartum following cystoscopy and drainage by means of ureteral catheterization. There was an obstruction to the right catheter about 2 to 3 cm. from the ureteral opening. Twelve days postpartum she was cystoscoped and turbid urines were obtained from both kidney pelves. An inbulging of the right ureteral opening was also noted. Cystogram showed a pronounced irregularity in the region of the right ureteral opening resembling a diverticulum. Pyeloureterograms were made, and films showed a large grade four pelvis on the right side with a right megalo-



ureter, tortuous throughout its extent. There was some dilatation of the left pelvis and ureter. The bladder had a large capacity. A bilateral renal ptosis was also noted. Another set of pyeloureterograms were taken, six weeks following delivery, and the conditions noted before were still present, but dilatation of the right ureter was not so pronounced.

Multiparae made up the largest group in this series with a total of 62 and the parity of this group was arranged as follows:

Para ii	28
iii	15
iv	10
v	1
vi	3
vii	2
viii	2
xi	1
	—
	62

The remaining 42 were, of course, primiparae.

The type of infection encountered was staphylococcus and *Bacillus coli*. Forty-one cases grew organisms on culture and in none of these were there any symptoms of genitourinary tract disturbance. Staphylococcus occurred in 34 and *Bacillus coli* in 7 cases. There was a total of 60 with evidence of focal infection, chiefly in the teeth; of that number 23 showed evidence of urinary tract infection, the remaining 37 did not. Evidence of infection was obtained on culture in 18 cases who were without focal infections on examination.

Other writers have found *Bacillus coli* to be the preponderant organism in urinary tract infection during pregnancy. It might be suggested that the large incidence of staphylococcus infection in our series could be due to the focal infections. We know that asymptomatic bacteriuria does occur in pregnancy, but one would hardly expect it in so large a number of cases.

Seven cases at subsequent examinations were diagnosed as definite higher urinary tract infection. In none of these could reflux be demonstrated. The distribution of these infections is as follows:

Bilateral Pyelitis	3	Right Pyohydronephrosis	
Left Pyelitis	2	with Right Hydroureter and	
Right Pyelitis	1	Bilateral Ptosis	1

From a consideration of our findings in this series, it would seem that if the pathology previously noted by Hofbauer is correct, and the lower portion of the ureters and trigone are involved in a structural change forming an "unyielding rigid tube," then reflux should be demonstrable in a larger number of cases, particularly in the multiparae who have had a number of pregnancies. We cannot conceive of the changes he describes taking place a number of times without causing an atonicity

of the lower end of the ureter and trigone. We are inclined to the belief that this structural change is a protective mechanism to preserve tone and function in these structures.

It would also seem apparent that only in an isolated case can reflux be demonstrated in an individual without signs of urinary tract infection. The presence of a higher urinary tract infection with involvement of the ureters and bladder is not sufficient to give rise to reflux unless accompanied by an atonicity of these structures; in that event, the infection and involvement of the genitourinary tract would be quite extensive as noted in our second case. Reflux could not be demonstrated in our seven cases of higher urinary tract infection, although one of these had progressed to the stage of a pyohydronephrosis with hydro-ureter.

The presence of cystocele during pregnancy is not an obstructive lesion in so far as reflux is concerned. In this series there were thirteen with cystocele, and reflux was not demonstrable.

We are of the opinion that the question of stasis should be given more consideration as an etiologic factor in pyelitis of pregnancy. In the two severe cases of infection in this series renal ptosis was demonstrated.

In no patient was there the slightest evidence of interference or interruption of the pregnancy as a result of the cystograms made in the Trendelenberg position.

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# AN ACCOUNT OF A YEAR'S SERVICE IN OBSTETRICS AT THE MORRISANIA HOSPITAL: A PUBLIC INSTITUTION\*

HARRY ARANOW, M.D., NEW YORK CITY, N. Y.  
(*Director of Obstetrics*)

I REALIZE fully that a short series of one thousand cases cannot be of great interest to a society of specialists, yet I believe such a report will add some proof to the theory that the most important causes of the prevailing high mortality rate are unnecessary interference and lack of proper training of the obstetric attendant.

Starting with a partly finished, partly equipped, new municipal hospital, a new staff of men who never worked together, a new staff of nurses, without any established technic, refusing no admissions and accepting all the desperate cases that are brought in by the public ambulance, we succeeded in making a fairly creditable record. This we did by eliminating unnecessary interference and so supervising the work of the staff, that, while enjoying full freedom of action, the men were guarded against going beyond their depth.

The Morrisania Hospital, a municipal institution, was opened on July 1, 1929. During the first year we had a total of 976 deliveries. Of these, 375 or 38 per cent of the mothers were primiparae and 601 or 62 per cent were multiparae, 739 or 75 per cent were white and 237 or 25 per cent were colored, 881 delivered normally and only 95 were delivered by operation, an operative incidence of 9.7 per cent.

TABLE I. OPERATIVE DELIVERIES

OPERATION	NUMBER	FREQUENCY	MATERNAL DEATHS	FETAL DEATH	
				NEO.	STILLBIRTH
Low forceps	57	5.9	0	1	2
Mid forceps	18	1.8	0	0	1
High forceps	0	0	0	0	0
Version	14	1.4	2	3	6
Cesarean section	6	0.6	0	1	0
Total	95	9.7	2	5	9

Forceps applications were strictly limited to definite indications in the interest of mother or child. The three fetal deaths in low forceps deliveries include, one macerated stillbirth, one "baby dead on admission," and one neonatal death caused by a congenital anomaly. The one stillbirth in a midforceps delivery was caused by a prolonged labor. There were no maternal deaths.

\*Read by invitation at a meeting of the New York Obstetrical Society, May 11, 1932.

Most of the versions were done for serious indications. As a result of the underlying complications, the maternal and fetal mortality was necessarily high. The indications included, prolapsed cord 2 cases, transverse position 2 cases, placenta previa 4 cases, toxemia 2 cases, delay in delivery of the second twin 3 cases, and elective 1 case. The causes of death in the mothers were bronchopneumonia 1 and eclampsia 1. There were 6 stillbirths as follows: a premature, one of twins (no apparent cause found), a prolapsed cord with no pulsation on admission, nephritis of mother and prematurity, placenta previa of mother and eclampsia of mother. There were 3 neonatal deaths, one baby with congenital atelectasis and two in mothers with placenta previa.

Cesarean section was resorted to 6 times, an incidence of 0.6 per cent. The indications were as follows: previous cesarean 2 cases, and contracted pelvis 4 cases. The low flap operation was done twice and the classical 4 times. There was no maternal mortality and one neonatal death was caused by a gastrointestinal anomaly.

There were 330 lacerations of the perineum, an incidence of 33 per cent, 186 were in primiparae and 146 in multiparae. Of the lacerations 247 or 75 per cent were first degree, 80 or 24 per cent second degree, and 3 or 0.9 per cent third degree. Unilateral episiotomy was performed 39 times, an incidence of 1.2 per cent, showing a strongly conservative tendency.

We had a total of 944 vertex, 29 breech and 3 transverse presentations.

Persistent occipitoposterior position requiring interference occurred 9 times, an incidence of 0.9 per cent. The Pomeroy maneuver followed by forceps was used 4 times, the Scanzoni 4 times, and manual rotation of the head followed by forceps once. We were fortunate in getting perfect results. The low incidence of interference in a successful series is a strong argument in favor of a "watchful waiting" policy in the treatment of posterior positions.

Face presentation occurred 3 times, 2 mentoanterior and one mentoposterior which rotated anteriorly. All delivered spontaneously.

Breech presentation was encountered 29 times, an incidence of 2.9 per cent. Our treatment was strictly conservative. We had no maternal mortality and an apparently high fetal death rate, 8 stillbirths and 2 neonatal. However, 7 of the 8 stillbirths were early, nonviable prematures, and one of the neonatal deaths was caused by a congenital primary anemia. This gives a corrected mortality of 2 or 6.9 per cent.

Transverse position occurred 3 times. One baby was dead on admission, one was stillborn, and one survived. All the mothers did well.

We had 31 cases of hemorrhage complicating pregnancy and labor. Nineteen were caused by atony of uterus, 2 by retained placenta, 6 by placenta previa, 3 by premature separation of placenta and 1 by rupture of uterus. In 11 of the cases of atony of the uterus the hemorrhage was controlled by massage, pituitrin, and ergot and in 8 by uterine packing. Of the retained placentas one delivered spontaneously and one had to be re-

moved manually. Five of the placenta previas were marginal and one central. They were all treated conservatively, one by rupturing the membranes, four by bagging followed by version, and one by forceps.

Because of some very tragic experiences with the conservative treatment of placenta previa, I have come to the conclusion that cesarean section is the safest procedure in the majority of cases. My associates, however, feel that in a well established hospital, with everything set for an emergency, the conservative treatment is just as safe and, thus far, they have proved their contention.

All the cases of premature separation of the placenta were mild. One delivered spontaneously and two were delivered by bagging and version.

The case of ruptured uterus was brought in on the ambulance in shock and died from shock and hemorrhage within an hour. This was our only death from hemorrhage and shock.

There were 21 cases of late toxemia of pregnancy; 6 preeclamptic, 6 nephritic, and 9 cases of true eclampsia.

Of the preeclamptics 4 were primiparae and 2 multiparae. They were all treated conservatively by rest in bed, eliminatives and, when indicated, sedatives. One para iv with a history of a previous eclampsia was induced by bougie and packing. All the mothers and all the babies, including one premature, were saved.

Our diagnoses of nephritic toxemia were checked by the recognized kidney function tests. Of the 6, 3 delivered normally, one was induced and delivered normally, one was delivered by forceps, and one by bagging and version. All the mothers recovered, but we lost 3 of the babies, one from the toxemia of the mother and 2 from prematurity.

All of our eclampsia cases were emergency, i. e., they were brought in on the ambulance, not one of them coming from our prenatal clinic. To the credit of the men in charge of our prenatal clinic let me repeat the fact that not one of their cases developed eclampsia. Of the 9 eclampsias 7 were in primiparae and two in multiparae: 5 developed convulsions antepartum, 1 intrapartum, 1 postpartum, and 2 combined. Our cases were nearly all of the severe, neglected type. They were all started on the Stroganoff method until the convulsions were controlled. If their general condition did not show any marked improvement, labor was induced. We lost two of the mothers, an uncorrected mortality of 22.2 per cent. Only two of the babies were full term and they were both saved. The other 7 were premature; 6 were stillborn, and one died shortly after birth.

Five cases of serious organic valvular heart disease were encountered. Four had double mitral lesions and one a mitral regurgitation. Two gave a history of previous decompensation and one was decompensated at the time of admission. With rest in bed (our rule is to keep all serious cases of cardiac disease in bed for four weeks before delivery), diet, medication, and careful management of their labor, all our patients delivered and were

discharged apparently none the worse for their experience. One baby died from congenital atelectasis.

According to our records we had only 9 cases of serious pelvic contraction; one general contraction, one funnel type, and 6 flat pelvis. The one with general contraction delivered normally after a prolonged labor. The 2 with contracted funnel type pelvis were delivered by cesarean section. Of the 6 with simple flat pelvis, 4 were delivered by cesarean section, one by mid-forceps, and one by version. All the mothers did well, but we lost 3 of the babies, one stillbirth from intracranial hemorrhage, one premature, and one from a complicating enterocolitis.

We had 75 patients in whom the temperature was 100.4 or over on two successive days exclusive of the day of delivery, an uncorrected morbidity of 7.7 per cent. In 25 of the cases the temperature was due to the following complications: pyelitis 4, cystitis 1, thrombophlebitis 1, upper respiratory infection 6, bronchopneumonia 3, catarrhal jaundice 1, ulcerative colitis 1, and wound infection in abdominal deliveries 2. We had only 11 cases of cracked nipple and one breast abscess. We attribute this good result to the short nursing periods at long intervals in our obstetric care during the first few days postpartum. In our opinion the most common cause of cracked nipple is suction on an empty breast.

Four maternal deaths occurred, an uncorrected mortality of 0.4 per cent. The features of these were as follows:

CASE 1. *Ruptured uterus*.—The patient was brought in to the hospital in severe shock. She had been under the care of a private physician and apparently in normal labor at home. Members of the patient's family saw the doctor give the patient a hypodermic injection. A few minutes later the doctor came out "in great excitement" and told the family that the patient had had a convulsion (?) and that she must be sent to a hospital at once. The patient delivered while she was being prepared in the labor room. The delivery was followed by a profuse hemorrhage. One of my associates expressed the placenta and packed the uterus and vagina. An infusion was started but the patient died. Postmortem examination showed a laceration of the cervix extending into the body of the uterus.

CASE 2.—Upper respiratory tract infection and prolapsed cord. Patient entered the hospital with prolapsed cord. She had a bad "cold," and was not in labor. For some unexplainable reason, one of my associates replaced the cord and packed the cervix and vagina although the cord was not pulsating. When the patient's pulse rose to 148 and the temperature to 101.8°, the following day he "added insult to injury" by doing a version and extraction. The next day the patient showed definite symptoms of bronchopneumonia and died four days later. Although the patient might have died from her bronchopneumonia, the operative bungling did not help her any.

CASE 3. *Eclampsia*.—A para ii, who had no prenatal care, suddenly began to vomit and had three violent convulsions. She was admitted in deep coma and never recovered consciousness. Delivery took place two hours after admission but her condition did not improve and she died two days later.

CASE 4. *Eclampsia*.—A para i, seven months pregnant. Patient had no prenatal care although she gave a history of vomiting and headache since the third month of her pregnancy. Three days prior to admission she developed edema of the face and ankles.

On admission the diagnosis of threatened eclampsia was made. Her urine showed a heavy trace of albumin, and a few hyaline and granular casts. Her blood chemistry was practically normal; her blood pressure was 198 over 130. She was put in a special eclampsia room, on a Carrell diet and eliminatives. Three days after admission she had a convulsion. On a modified Stroganoff treatment she seemed to improve; her mind was clear and she had no convulsions for five days. Then several convulsions came in rapid succession. Labor was induced with a Voorhees' bag and she was delivered the same day. However, she went into coma and died two days later. I do not know exactly where we made our mistake, but I feel that this patient might have been saved by more radical treatment.

#### SUMMARY

A series of nearly a thousand cases was delivered in a municipal hospital under strictly conservative obstetrics with a total operative incidence of less than 10 per cent, a cesarean section incidence of 0.6 per cent, an uncorrected maternal mortality of 0.4 per cent, and an uncorrected morbidity of 7.7 per cent. If we eliminate the cases of ruptured uterus and fulminating eclampsia (both outside cases which were brought to the hospital in extremis), our mortality was only 0.2 per cent. If we eliminate all non-obstetric causes our morbidity rate was 5 per cent.

In conclusion I wish to thank my former resident, Dr. Jacob Clahr, who has gathered and classified this material for me.

#### ABSTRACT OF DISCUSSION

DR. GEORGE W. KOSMAK.—Dr. Aranow is to be commended for developing in his staff the conservative attitude of mind which is reflected in such satisfactory results. We need more presentations of this kind to convince us that a conservative course in obstetrics is the proper one to pursue. I think his statistics of operative incidence probably measure up lower than those of any other service in the city that I know of, and particularly in the public hospitals.

It has seemed to me, after a study of the puerperal mortality figures that are now being prepared by the Committee of the New York Academy of Medicine, that some radical steps will have to be taken in the near future to evaluate the work of the men on obstetric services. In other words, we will have to make an accounting in the very near future of the individual operator's work and to evaluate his standing, ability, and competency by the results that he produces. It may seem a little bit extreme perhaps to call in an accountant to judge the medical problems, but that is really the only way to know whether a man is doing good work or not, and the day will come in the very near future when services are going to be judged by the capacity of the individual workman. That has not as yet been attempted in this country, although it is widely practiced abroad. When we have institutions with an operative incidence of 33 to 50 per cent, with a correspondingly high mortality, it seems necessary to make some analysis of the individual operator's work in those particular hospitals, and until that evaluation is done and until we can definitely determine whether it is fair for any man to have such a high mortality in obstetrics as we find some of our New York men are having, then I think we are not going to improve our maternal mortality statistics.

DR. B. P. WATSON.—It struck me that the incidence of abnormal pelvis was extremely small, much smaller, for instance, than we have at the Sloane Hospital. The reason for this may be that we select our patients, taking those who show abnormalities of any kind in preference to those who appear normal. Our operative incidence also is much higher.

It is a very good thing indeed to have this presentation made, showing that there can be such a low operative incidence as 9 per cent. We know that in some clinics, as for instance in the West End Maternity Hospital, London, the operative incidence is as low as 3 per cent. There is no doubt that in some of our hospitals the operative incidence is unnecessarily large.

Perhaps the only criticism I have to make is in regard to Dr. Aranow's treatment of eclampsia. Why does he induce labor in the presence of active eclampsia when he is otherwise so conservative? I believe that when a patient is actually having convulsions it is probably better to leave the labor severely alone.

DR. HARRY ARANOW.—Dr. Watson's criticism is well taken. However, these cases did not have any more convulsions. We control the convulsions with the Stroganoff method and then wait to see whether they will clear up, if they do not, we put in a bag.

I do not doubt for a minute that there were a great many more cases of abnormal pelvis in this series. Evidently a great many who delivered normally were passed by without being detected.

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Unterberger, and Kirsch: Attempts to Influence the Sex Ratio Among Rabbits According to the Procedure of Unterberger. *Monatschr. f. Geburtsh. u. Gynäk.* 91: 17, 1932.

The authors attempted to verify experimentally Unterberger's contention that the use of sodium bicarbonate before intercourse results in a higher proportion of males among human beings. Rabbits were used for the experiments because the influence of the vagina can be definitely determined before coitus. In some cases sodium bicarbonate was instilled into the vagina just before the sexual act and and in other cases, lactic acid was used. It has not been decided as to how alkalies effect spermatozoa but it may be that the male-producing spermatozoa are made to increase their motility and therefore reach the ovum first. The female-producing sperm are certainly not destroyed but are only inhibited and therefore do not reach the ovum as quickly as the other sperm. However, they may fertilize ova which are expelled late. In spite of the latter fact the authors found that one animal before any change was made in the vagina gave birth to 28 males and 56 females. On the other hand, after the use of sodium bicarbonate, she gave birth to 80 males and 41 females. If all the data are collected after the use of sodium bicarbonate there resulted 142 males in contrast to 65 females.

J. P. GREENHILL.



## A SURVEY OF CESAREAN SECTIONS PERFORMED IN PHILADELPHIA DURING 1931\*

CLIFFORD B. LULL, M.D., PHILADELPHIA, PA.

THERE have appeared in the literature during the past few years, reports of surveys made in different cities of the United States on the incidence and mortality of cesarean section. The Council of the Philadelphia Obstetrical Society decided to make this problem the subject of an annual study. I was selected to make this survey for the year 1931. Dr. Barton Cooke Hirst and Dr. Phillip Williams were asked to serve in an advisory capacity and their aid and advice have been most graciously given. Without the cooperation of the chiefs of the Obstetrical and Gynecological Services and the various hospitals record rooms, this study would have been impossible, and I wish to thank them for this assistance. Every hospital in the city limits has been surveyed and we believe this includes the record of every cesarean operation done in the city of Philadelphia during this period. The number of births and maternal deaths have been checked with the aid of the Bureau of Vital Statistics and the Maternal Welfare Committee of the Philadelphia County Medical Society. I also wish to thank Dr. Charles Gordon of Brooklyn for his aid in the preparation of the blanks for this study.

As this is entirely an impersonal survey, each hospital has been given a number and they are so recorded in Table I. No effort was made to list the operator in each case. Careful inquiry makes me believe that although we are still, and always will be afflicted with the occasional operator, most of these patients have been operated upon by a trained man or under the supervision of one of the attending obstetricians. It might also be stated that the uterus and its appendages are still to a certain extent, the playground of the general surgeon.

In some surveys that have been made, all hysterotomies done before the thirty-fourth week of gestation have been excluded. In this study, all hysterotomies irrespective of the time done, have been tabulated.

Table I lists each hospital separately with the total number deliveries, number of cesarean sections done, and the percentage incidence. The highest incidence, No. 34 with 42 deliveries for the year, 7 cesarean sections, percentage incidence 16.6, had 0 death; No. 29 with 194 deliveries, 18 cesarean sections, and a percentage of 9.2 had no deaths; No. 27, 124 deliveries, 9 cesarean sections, percentage 7.2, had 1 death; and No. 6, 43 deliveries, 3 cesarean sections, percentage 6.9, 1 death. Nine hospitals with a total number of 1329 deliveries, report no cesarean operations done during the year 1931.

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\*Read at a meeting of the Obstetrical Society of Philadelphia, May 5, 1932.

TABLE I

	NO.	NO.	PER CENT		NO.	NO.	PER CENT
HOSPITAL	DELIVERIES	SECTIONS	INCIDENCE	HOSPITAL	DELIVERIES	SECTIONS	INCIDENCE
1	264	2	0.75	25	12	0	0
2	142	0	0	26	449	19	4.2
3	135	0	0	27	124	9	7.2
4	401	7	1.7	28	82	3	3.6
5	49	0	0	29	194	18	9.2
6	43	3	6.9	30	2054	91	4.4
7	500	8	1.6	31	1427	36	2.5
8	1308	9	0.68	32	553	21	3.7
9	334	6	1.7	33	512	7	1.3
10	650	1	0.15	34	42	7	16.6
11	53	1	1.8	35	15	0	0
12	570	10	1.7	36	520	16	3.0
13	1523	31	2.0	37	390	12	3.0
14	934	39	4.1	38	463	3	0.64
15	1035	26	2.5	39	711	11	1.5
16	816	16	1.8	40	462	6	1.2
17	458	0	0	41	144	5	3.4
18	246	7	2.8	42	654	5	0.76
19	179	4	2.2	43	603	24	3.9
20	53	0	0	44	864	26	3.0
21	750	17	2.2	45	396	3	0.75
22	90	2	2.2	46	452	0	0
23	881	36	4.0	47	13	0	0
24	961	26	2.7				

TABLE II

Births in City	35,284
Births occurring in hospital	23,511
Total number cesarean sections	573
Per cent incidence in entire birth rate	1.6
Per cent incidence in hospital delivery	2.4

Table II shows the total number of births reported in the entire city, the total number of births in the hospital, with total number of cesarean sections, percentage incidence of cesarean sections born in reference to hospital deliveries and entire city birth rate. Attention is called to the large number of hospital confinements occurring in Philadelphia. In this year's *Year Book of Obstetrics and Gynecology* the percentage of home deliveries as reported in an abstract was commented upon by Doctor DeLee as being higher than he himself had found. He made the note that his idea was that about 50 per cent of all women confined were in a hospital at that time. As is seen by our figures, a much higher percentage were confined in hospitals.

Table III shows the number of primigravida and multigravida patients delivered by the abdominal method.

TABLE III

Number cesarean sections	573
Primigravida	284
Multigravida	289

Table IV lists the number of patients whose membranes had ruptured before operation; those that had been given a test of labor; those operated upon at the time of election, in other words before the onset of labor; those having been examined vaginally, and five cases where one or more attempts had been made at vaginal deliveries before admission to the hospital. The number of vaginal examinations made varied from one to ten. Of the five

TABLE IV

Membranes ruptured	108
In labor	268
Not in labor	305
Vaginal examination	156
Attempted vaginal deliveries	5

TABLE V. INDICATIONS FOR OPERATION

Cephalopelvic disproportion	328
Placenta previa	42
Preeclamptic toxemia	29
Eclampsia	14
Previous section (no other indication)	16
Premature separation, normal implanted placenta	19
Cardiovascular disease	21
Transverse position	12
Obstructing tumors	9
Rigid cervix	6
Ischiorectal abscess	1
Uterine inertia	7
Fetal distress	4
Pulmonary tuberculosis	4
Feeble-minded idiot	1
Arthritis deformans	1
Sterilization	4
Exhaustion	4
Ruptured uterus (one having previous cesarean section)	3
Twin pregnancy (large babies)	1
Stricture of rectum	1
Hepatic toxemia	1
Epilepsy	1
Brow presentation	6
Abdominal pregnancy	1
Deformity of hip	2
Monstrosity	3
Previous complete laceration (repaired)	2
Breech (elective)	7
Ventral fixation of uterus	3
Anus vestibularis	1
Previous extensive plastic operation	2
Elective	6
Tuberculous spine	1
Threatened rupture cesarean scar	2
Parietal bone presentation	1
Cerebrospinal meningitis	1
Subarachnoid hemorrhage	1
Carcinoma of cervix	1
Previous Watkins interposition operation	1
Constriction of birth canal	1
Bandl's contraction ring	1
Bicornate uterus	1

cases where a definite record was obtainable of attempted vaginal delivery, three patients died. Detailed account of these will be made later.

The term cephalopelvic disproportion has been used to include all cases of absolute contraction of the pelvis and those borderline cases where the size of the fetal head was too large for the pelvic inlet. Under previous cesarean section are included 16 cases in which the first cesarean section was done for an indication such as placenta previa or premature separation, and where the indication at the time of the present operation was only the fact that the patient had previously been operated upon. A further study of the cases having previous cesarean sections performed upon them will occur later. Obstructing tumors of which there were 9, include fibromyomas of the uterus and the tumors of the appendages and birth canal which caused obstruction. The 4 cases listed under sterilization, had no indication other than the fact that it was desirable of performing this operation because of some constitutional or mental condition present in the patient. Under the head of exhaustion there occurred 4 cases. These 4 cases were given long tests of labor but made no progress as far as dilatation of the cervix and descent of the presenting part were concerned. Of the 3 patients with ruptured uterus, only 1 had had a previous cesarean operation. The twin pregnancy occurred in a patient having two large children with no fetal part at the pelvic brim and tremendous distention of the uterine cavity. Three monstrosities were such that vaginal delivery would have meant more traumatism to the maternal soft parts. There were 7 cases of breech presentation where the babies were large and where it was elected to deliver by cesarean section because of the possibilities of fetal injury. The previous extensive plastic operations were such that vaginal delivery would have been accomplished with a great deal of difficulty. Only 6 cases in this series should be classified as elective operations and all of these, although they did not present pelvic deformities or the ordinary indications for abdominal delivery, had had previous children with loss of the child due to difficult and prolonged labors. Two patients who previously had had a cesarean section appeared to have symptoms of rupture of the scar, but at operation it was found that the scar was intact.

TABLE VI. OPERATIONS DONE

High	458
Low	103
Celi hysterectomy (Porro)	10
Vaginal hysterotomy	1
Abdominal pregnancy	1

It is interesting to note that by far the vast proportion of cesarean sections done in the city of Philadelphia were of the so-called classical type, 458 being by this method and only 103 by the low method. A discussion of the mortality rate in these two classes of cases is contained in Table XVI. A great deal has been written about the advisability of performing the

low operation routinely, but as seen from the above statistics, this view has not been accepted by most of the obstetricians in this city. We are all convinced that it is unquestionably an operation which every obstetrician should be qualified to do, but up to the present time it has not seemed appropriate by the majority to accept it as a routine procedure. A further discussion of the advisability of performing this operation more frequently will be taken up under the discussion of the mortality. The one patient with abdominal pregnancy who was operated upon, recovered.

TABLE VII. INCIDENTAL OPERATIONS

Sterilization	85
Appendectomy	4
Salpingo-oophorectomy	5
Myomectomy	17
Herniorrhaphy	2

In this group of 573 patients operated upon, 85 had sterilization operations performed. The methods of sterilization varied according to the individual operator and the indications were mostly one or more previous cesarean operations. Salpingo-oophorectomies were performed upon 5 patients who had complicated ovarian cysts. Of the 17 myomectomies, the majority were done incidental to the cesarean section and were not the primary cause of dystocia. The 2 herniorrhaphies were for umbilical hernia and for ventral hernia in an old abdominal scar.

TABLE VIII. ANESTHESIA USED

Gas ether	311
Ether	154
Local	46
Nitrous oxide	43
Spinal	14
Ethylene	5

Table VIII is a résumé of the types of anesthesia used. Gas oxygen ether sequence was the one most generally given. Only 46 of these cases were done under local, a method which I believe is becoming more and more popular. Of the 14 cases done under spinal anesthesia, 2 patients died before the operation was started. The reason that ethylene was not used

TABLE IX

Live births	502
Stillborn or died within a few days	74
3 sets of twins in 573 cases	
Total babies	576
Fetal mortality	12.8%
Unavoidable fetal deaths	36
Corrected fetal mortality	6.2%

more frequently seems to be due to the fact that most of the hospitals had discarded its use because of its dangerous properties.

Table IX shows the number of fetal deaths. In order to arrive at the corrected fetal mortality, 36 cases were subtracted from the total baby deaths, 74. Among the 36 cases were all babies born before the eighth month and monstrosities which would have been impossible to survive after any type of delivery. The remaining 38 were mostly babies who had been subjected to long labors before cesarean section was done. There may have been a few of these 38 which, if a more detailed report were given, could have been excluded from the fetal mortality.

TABLE X. PREVIOUS SECTIONS

No. having previous cesarean section	107
No. with previous cesarean section as only indication	11
No. operated upon at time of election	79
No. in labor when operated upon	28
(One 16 hours, one 24 hours, rest 2 to 6 hours)	
Deaths in this group (In labor 16 hours)	1

Attention is called to the fact that there were only 11 patients in this group of 107 who were operated upon at this time because they had had previous cesarean sections with no permanent indication for the operation. In other words, these 11 patients had had the first cesarean section because of central placenta previa, premature separation, or toxemia. Attention is also called to the fact that practically none of these patients had any long labor before operation, 79 being operated upon at the time of election. As there was only one death in this group, I feel that it again demonstrates the advisability of decision in certain types of cases before the onset of labor.

TABLE XI

Total number of births in all hospitals	23,511
Total number of cesarean sections in all hospitals	573
Number of hospitals having no deaths	25
Total number of births in these hospitals	8,859
Total number of cesarean sections in these hospitals	184
Per cent incidence of all births in these hospitals	37.6
Per cent incidence of all cesarean sections in these hospitals	32.1

Table XI shows that there were 25 of the 47 hospitals which had no deaths from the operation and in these 25 hospitals, 32.1 per cent of the total number of operations was performed. Most of this group of course include several of the smaller hospitals, but there was also included in this number several hospitals where a fairly large number of operations were performed without any maternal mortality.

Table XII gives a fairly reasonable index of the incidence of cesarean section and incidence of deaths occurring in the other hospitals.

TABLE XII. HOSPITALS HAVING DEATHS

HOSPITAL	NO. BIRTHS	NO. SECTIONS	PER CENT SECTIONS	DEATHS	PER CENT DEATHS
6	43	3	6.9	1	33.3
7	500	8	1.6	1	12.5
8	1308	9	0.68	1	11.1
14	934	39	4.1	3	7.6
15	1035	26	2.5	3	11.5
16	816	16	1.9	1	6.2
18	246	7	2.8	1	14.2
19	179	4	2.2	1	25.0
21	750	17	2.2	2	11.7
22	90	2	2.2	1	50.0
24	961	26	2.7	1	3.8
26	449	19	4.2	1	5.2
27	124	9	7.2	1	11.1
30	2054	91	4.4	6	6.5
31	1427	36	2.5	2	5.5
36	520	16	3.0	2	12.5
37	390	12	3.0	2	16.6
39	711	11	1.5	2	18.1
40	462	6	1.2	2	33.3
42	654	5	0.76	1	20.0
43	603	24	3.9	2	8.3
45	396	3	0.75	2	66.6
Totals	14652	389	2.6	39	10.0

TABLE XIII

Total cesarean sections	573
Total maternal mortality	39
Per cent incidence of maternal mortality	6.8

A maternal mortality of 6.8 per cent is the result in the entire city which includes all types of operations.

TABLE XIV. MORTALITY IN OTHER SURVEYS

CITY	NO. SECTIONS	NO. DEATHS	PER CENT DEATHS
Cleveland	1047	75	7.15
Brooklyn	1805	128	7
Los Angeles	1550	73	5.1
Philadelphia	573	39	6.8
Totals	4975	315	6.3

Table XIV is a summary of the survey done in three other cities to which has been added this present survey in Philadelphia. The maternal mortality of 6.8 per cent in Philadelphia compares with the other surveys favorably, but as this work was only carried out over a period of one year the total number of cases is not sufficient to be compared with the other totals.

Leading the causes of maternal deaths is sepsis. This classification was made as simple as possible and also as accurate as could be obtained from

TABLE XV. CAUSES OF MATERNAL DEATHS

	TOTAL	PER CENT INCIDENCE
Sepsis	18	46.1
Hemorrhage and shock	11	28.2
Cardiac failure	2	5.1
Uremia	1	2.5
Spinal anesthesia	2	5.1
Late hepatic toxemia	1	2.5
Embolism	1	2.5
Nephritic toxemia	1	2.5
Cerebrospinal meningitis	1	2.5
Pneumonia	1	2.5

the records. A large number of patients unquestionably died from sepsis were listed as cardiac deaths, with the word peritonitis rather in the background. Where there was no evidence of cardiac disease preceding the operation upon the patient, the cause of death was finally put down as sepsis. Almost one-half the mortality came in this group. The one case of embolism occurred on the eleventh day following operation in a patient who was apparently making a normal recovery. The case of cerebrospinal meningitis was moribund on admission to the hospital and had a cesarean section done in the interest of the child. Under the heading of hemorrhage and shock there were included the 5 cases of eclampsia; the patients either died on the table or within a few hours afterward.

TABLE XVI

	TOTAL	DEATHS	PER CENT MORTALITY
No. of classical operations	458	31	6.7
No. of low operations	103	4	3.8
No. of celiohysterectomies	10	4	40.0
Total number of deaths		39	

Table XVI shows the maternal mortality occurring in various types of operation and as is seen in this group, the percentage maternal mortality is 50 per cent less in low cervical section when compared with the high operation. Skeel and Jordan in their most recent survey of cesarean sections in Cleveland reported a number of other individual surveys with a comparison between the classical and the cervical operation. Their conclusions are that the cervical section mortality averages a little less than one-half that of the classical section. They have also shown that the hospital having the highest percentage of cervical operations also had the lowest total cesarean section mortality. Although a separate tabulation has not been made of the aforementioned question, the hospital having the lowest maternal mortality with a fairly large number of operations done, was an institution in which the selection of the case for the classical and the low operation seemed to be done very accurately. My final conclusions



in looking over this problem from this standpoint are that there is still a place for the classical operation, and as has always been said, the mortality will always be greatest where the poorest judgment is used in the selection of the patient for any type of abdominal delivery.

According to these statistics the operation of celiohysterectomy carries a definitely higher maternal mortality.

TABLE XVII. INDICATIONS FOR OPERATION IN THE 39 FATAL CASES

	TOTAL CASES	MORTALITY	PER CENT MORTALITY
Cephalopelvic disproportion	328	17	5.1
Ruptured uterus	3	2	66.6
Eclampsia	14	5	35.7
Preeclamptic toxemia	29	3	10.3
Brow presentation	6	2	33.3
Placenta previa	42	3	7.1
Premature separation	19	3	15.7
Cerebrospinal meningitis	1	1	100.0
Cardiac disease	21	2	9.5
Uterine inertia	7	1	14.2

Table XVII includes the 39 fatal cases with the total number of cases in each incidence, allowing us to figure the percentage mortality in these various indications. Attention is called to the fact that there were 14 patients who had eclampsia operated upon with 5 deaths, a mortality of 35.7 per cent. Also there were 21 patients operated upon because of cardiac disease with only 2 deaths. Both of these fatal cases evidently had very serious cardiac disease and died within forty-eight hours after operation. The delivery of women with severe cardiac damage by cesarean section, particularly under local anesthesia, has become more and more popular.

In Table XVIII there are several typical pictures of the reason for death following cesarean section. For example: a patient in labor twenty-six hours, 4 vaginal examinations, membranes ruptured for fourteen hours, classical operation done; one would expect the natural outcome, death from sepsis. Attention is also called to the fact that there is a mortality from cesarean section even when the patient is not in labor, has had no vaginal examinations, and the membranes have not ruptured. One of these patients who had been in labor twenty-four hours, membranes having ruptured only two hours before operation and supposedly not having had any vaginal examinations, had the classical operation performed and died of sepsis. Just before death it was found that an attempt had been made to deliver this patient on the outside, of which there was no history at the time of operation. The patient who died of hepatic toxemia was evidently one of these rare hepatic types of late toxemia which are usually fatal and died of the liver damage fifteen days following section.

The first case, brow presentation, evidently had severe hemorrhage at the

TABLE XVIII. RÉSUMÉ OF FATAL CLASSICAL OPERATIONS (TOTAL 31)

INDICATION	HOURS LABOR	VAG. EXAM.	HRS.		CAUSE OF DEATH
			MEMB.	RUPT.	
Cephalopelvic disproportion	35	0	12		Cardiac failure
Cephalopelvic disproportion	48	0	yes		Sepsis
Cephalopelvic disproportion	26	4	14		Sepsis
Cephalopelvic disproportion	48	2	0		Sepsis
Cephalopelvic disproportion	0	0	0		Sepsis
Cephalopelvic disproportion	48	2	24		Sepsis
Cephalopelvic disproportion	62	0	0		Sepsis
Cephalopelvic disproportion	48	3	0		Sepsis
Cephalopelvic disproportion	0	0	0		Sepsis
Cephalopelvic disproportion	0	0	0		Sepsis
Cephalopelvic disproportion	24	0	2		Sepsis—attempt to deliver at home
Cephalopelvic disproportion	21	0	0		Spinal anesthesia, before operation
Cephalopelvic disproportion	0	0	0		Sepsis
Cephalopelvic disproportion	72	4	0		Shock and hemorrhage
Eclampsia	24	3	?		Shock and hemorrhage
Eclampsia	8	1	?		Shock and hemorrhage
Eclampsia	0	0	0		Spinal anesthesia, before operation
Eclampsia	0	0	0		Shock and hemorrhage
Eclampsia	0	0	0		Shock and hemorrhage
Preeclamptic toxemia	0	0	0		Hepatic toxemia, 13 days
Preeclamptic toxemia	0	0	0		Shock and hemorrhage
Brow presentation	36	5	?		Sepsis
Placenta previa	6	0	0		Embolism, 16 days
Placenta previa	12	0	0		Cardiac failure
Placenta previa	10	0	0		Shock and hemorrhage
Premature separation	12	0	0		Cardiac failure
Premature separation	5	0	0		Nephritic toxemia, 11 days
Premature separation	0	0	0		Shock and hemorrhage
Cerebrospinal meningitis	0	0	0		Cerebrospinal meningitis
Cardiac disease	0	0	0		Cardiac failure
Cardiac disease	0	0	0		Sepsis (cardiac)

time of operation and died shortly after return from the operating room. The patient who had preeclamptic toxemia unquestionably died of gradual uremia which was fairly well advanced before operation and in spite of emptying the uterus, continued to develop until death ensued on the fourth

TABLE XIX. RÉSUMÉ OF FATAL LOW OPERATIONS (TOTAL 4)

INDICATION	HOURS LABOR	VAG. EXAM.	HRS.		CAUSE OF DEATH
			MEMB.	RUPT.	
Brow presentation	29	0	0		Shock and hemorrhage
Preeclamptic toxemia	0	0	0		Uremia (fourth day)
Cephalopelvic disproportion	70	1	72		Sepsis (1 attempt vaginal delivery)
Cephalopelvic disproportion	11	0	?		Sepsis

day. The test of the advisability of doing the low operation instead of hysterectomy was severely tried in the other two cases. The possibilities are, that both of these women had entirely too long a test of labor.

TABLE XX. RÉSUMÉ OF FATAL CELIOHYSTERECTOMIES (TOTAL 4)

INDICATION	HRS.			CAUSE OF DEATH
	HOURS LABOR	VAG. EXAM.	MEMB. RUPT.	
Ruptured uterus	2	2	1½	Hemorrhage and shock
Ruptured uterus	34	many	30	Hemorrhage and shock (forceps, version and craniotomy)
Cephalopelvic disproportion (fibroids)	16	0	0	Sepsis
Uterine inertia	54	4	54	Sepsis (everything tried first)

Four deaths occurred from the Porro operation. All of these were very bad operative risks at the time of operation. The 2 patients with ruptured uterus had not been previously sectioned but had had definite manipulation before admission to the hospital. The patient with the fibroids complicating cephalopelvic disproportion had been allowed to be in labor sixteen hours before operation, and the patient listed under uterine inertia

TABLE XXI. COMPARISON OF OTHER SURVEYS IN PLACENTA PREVIA

CITY	CASES	MATERNAL DEATHS	RATE PER CENT
Cleveland	137	7	5
Brooklyn	98	7	7
Los Angeles	68	4	6
Philadelphia	42	3	7.1
Totals	345	21	6.0

TABLE XXII. COMPARISON OF OTHER SURVEYS IN PREMATURE SEPARATION

CITY	CASES	MATERNAL DEATHS	RATE PER CENT
Cleveland	30	1	3.3
Brooklyn	19	0	0
Los Angeles	25	2	8
Philadelphia	19	3	15.7
Totals	93	6	6.4

TABLE XXIII. COMPARISON OF OTHER SURVEYS IN ECLAMPSIA

CITY	CASES	MATERNAL DEATHS	RATE PER CENT
Cleveland	45	9	20
Brooklyn	104	27	26
Los Angeles	46	13	28
Philadelphia	14	5	35.7
Totals	209	54	25.8

TABLE XXIV. COMPARISON OF OTHER SURVEYS IN PREECLAMPTIC TOXEMIA

CITY	CASES	MATERNAL DEATHS	RATE PER CENT
Cleveland	66	3	4.5
Brooklyn	106	7	6.6
Los Angeles	187	11	6
Philadelphia	29	3	10.3
Totals	388	24	6.1

had had everything from bougies and bags to version, forceps, and craniotomy tried before the operation was done.

TABLE XXV. RECAPITULATION OF PHILADELPHIA SURVEY

Total number births in city	35,284
Total number births in hospitals	23,511
Total number of cesarean sections	573
Maternal mortality of entire births	203
Maternal mortality of cesarean section	39
Per cent maternal mortality due to cesarean section	19.2
Per cent incidence of cesarean section in entire city	1.6

Tables XXI, XXII, XXIII and XXIV are comparisons with the Philadelphia statistics and those returned from other surveys.

#### CONCLUSIONS

1. A great deal of information concerning the use and abuse of cesarean section has been obtained from these statistics.

2. The incidence of cesarean section for the entire city, we do not consider to be high. The incidence of cesarean section in a few hospitals seems to be a trifle higher than the majority.

3. The incidence of confinements occurring in hospitals in Philadelphia has increased in the last decade.

4. The indications for doing cesarean section have increased during the past few years. However, we believe that this increase in the number of indications is justifiable, and that the operation has not been abused except that possibly in a few cases listed as cephalopelvic disproportion there may have been some instances where the imagination was stretched a trifle.

5. The high or classical operation up to the present time seems to be used more extensively than the low operation. This survey bears out the fact as has been found in other statistical studies, that the mortality rate of the low operation is approximately one-half of the high operation.

6. From the number of incidental operations performed in this group of 573 cases, we believe that most men think it good surgery not to do more than the cesarean operation unless it is absolutely necessary.

7. Spinal anesthesia is questionably a safe procedure in pregnant women at full term, and we believe that the use of local anesthesia will become more generally advocated.

8. The fetal mortality in this group of cases is too high and can probably be accounted for by allowing the patient to undergo too severe a test of labor before cesarean section was decided upon.

9. Patients having previous cesarean section were usually operated upon at the time of election, and had the lowest mortality rate. The operation of cesarean section done at the time of election irrespective of whether the high or the low operation is done, is undoubtedly the safest.

10. One hundred and eighty-four cesarean sections were done in twenty-five different hospitals without a maternal death. A careful study of the records of some of these hospitals shows that the judgment of the men in charge as to the time to operate upon a patient, the type of operation to be done, and the anesthetic to be used, played an important part.

11. A maternal mortality of 6.8 per cent is about the average throughout this country. This unquestionably could be reduced by more careful judgment of the time to operate upon a patient, the type of operation done, and the anesthetic used.

12. Sepsis is still the most frequent cause of death in cesarean section and will still continue to be as long as women are allowed to remain in labor with ruptured membranes, frequent vaginal examinations, and classical cesarean section. If the mortality rate as proved by not only these statistics, but by those of various other writers, is one-half that in the low operation as in the high operation, it would seem only feasible that more men should adopt this operation into their obstetric armamentarium. A great deal probably depends upon the method of closure of the uterus as several men are still doing this so-called classical operation in cases where the low operation would seem to be indicated, but whose results are satisfactory. Their good results are probably obtained by the fact that the incision is made in the lower part of the uterus without dissecting a flap, but where the closure of the uterus is very carefully done. That there is still a definite place for the classical operation, I believe to be unquestioned, and unless one is thoroughly trained, a high operation is much less likely to be fatal from shock or hemorrhage, but it is perfectly obvious that in a potentially infected case the classical operation is not the operation of choice.

13. Once more it is shown that women who are suffering from eclampsia are not suitable risks for abdominal surgery.

14. In spite of a maternal mortality of 6 per cent, cesarean section seems to be the most favorable method in the treatment of central placenta previa.

And finally, we again reiterate that the mortality rate in cesarean section lies with the individual judgment of the operator in the selection of

the time to do the operation, the type of operation to be done, and the anesthetic to be used.

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1731 PINE STREET.

#### ABSTRACT OF DISCUSSION

DR. BARTON C. HIRST.—This survey is useful in calling the attention of the profession, and, I hope, of the laity also, to the fact that cesarean section ought not to be resorted to as lightly as it so often is, especially in some of the smaller communities of the country.

I know personally of a case which may serve as an example. A young primigravida in perfect physical condition had a breech presentation. On entering the hospital of a small city she was informed that she was to have a cesarean section. Apparently the sole indication was the breech presentation. During the night of the labor I was called upon repeatedly to sanction the section, but the next morning, just as I entered the hospital the baby was born, as I had expected.

I believe that cesarean section has a very important place occasionally in the treatment of eclampsia.

We had some interesting experiences with it in the University Maternity Hospital. During five years we had 87 cases. In that number of 87 eclampsia cases, we had 17 resisting all the ordinary methods of treatment, but all recovered, although they were the worst in the list.

DR. G. W. OUTERBRIDGE.—A patient recently seen in a small community had previously had a baby by a perfectly normal delivery. She became pregnant again, and went to a general surgeon who had a small private hospital. He began talking cesarean section. She did not see why, but he told her that during the previous year he had done 73 cesarean sections. She was in labor a few hours, and a cesarean section was done. She was one of four cases in this small private hospital at the same time, one of whom died.

DR. EDWARD A. SCHUMANN.—I question very much, not the value of these surveys, but their interpretation.

To any one of us, there may come the primipara with short pelvic measurements and in whom a careful obstetric examination, just before term, discloses the probability of a long and difficult labor with its attendant maternal mortality. In considering the possibility of elective section in such a patient, one should certainly not be compelled to regard as a contraindication the high mortality as given in this and other surveys. When section is grouped as a single procedure without regard to the time at which the operation is performed, the condition of the patient and the ability of the operator, I feel that the statements are most misleading because the actual mortality rate of elective cesarean section in skilled hands is so low as to be practically negligible. Again in the comparison of the low operation with the classical we must remember that the low procedure is much more generally employed by specialists in obstetrics while the simpler classical operation is performed by those less skilled and by occasional operators. Here again, then, I feel the comparison of mortality is erroneous. With regard to the place of cesarean section in eclampsia, I maintain that it has a very distinct though limited place and that in cases where delivery by the vaginal route offers great difficulty and where no improvement in the toxic condition is observed after a reason-

able application of sedative and eliminative measures, cesarean section with local anesthesia offers the best hope for a successful outcome.

DR. T. L. MONTGOMERY.—The maternal mortality in 9,823 cesarean deliveries reported from various metropolitan areas in the United States shows that the operation is nearly seven times more dangerous than natural delivery. In the United States the general maternal death rate is 6.2 per 1000 live births. The maternal death rate for abdominal delivery, however, is nearly 70 per 1000 live births. It is interesting to note that the maternal mortality rate for Philadelphia in 1931 corresponds precisely with the average mortality rate reported in these several metropolitan areas.

In Germany, in 1928, 4,450 cesarean sections were performed with 316 maternal deaths, a maternal mortality of 7.1 per cent.

In a series of 16,296 cesarean sections which have been reported from this country and from Europe, there were 1,059 maternal deaths or a mortality rate of 6.5 per cent.

## CYSTIC FIBROID WEIGHING FORTY-SEVEN POUNDS AND SIMULATING AN OVARIAN CYST

J. P. GREENHILL, M.D., CHICAGO, ILL.

*Attending Gynecologist, Cook County Hospital*

IN AN article on "Cystic Fibroid With Twisted Pedicle, Simulating an Ovarian Cyst," which appeared in the January, 1932, issue of the AMERICAN JOURNAL OF OBSTETRICS AND GYNECOLOGY, Spiraek and Pilot give a detailed description of this condition and cite the few cases reported in the literature where the tumors were very large. Because of the rarity of the occurrence of large uterine fibrocysts, the difficulty in making a correct clinical diagnosis and the relatively large number of deaths which occur without operation due to disturbances in circulation, breathing and cachexia, I am reporting the following case.

### CASE REPORT

Mrs. D. McC., colored, aged forty-eight years, was admitted to the Cook County Hospital on October 12, 1928, because of a huge swelling in the abdomen. The past history was unreliable because of the poor mental condition of the patient, but it was essentially negative. She had never been pregnant. The swelling of which the patient complained began about seven years before admission and at first was limited to the left side of the lower abdomen. For about five years the growth of this mass was slow but during the last two years, the increase in size was rapid and extended over the entire abdomen. During the past year a physician performed paracentesis about 75 times and he said that each time a few quarts of clear, slightly serous fluid was obtained. After each paracentesis, the swelling diminished in size. During the past two months, the patient had two paralytic strokes. The first caused paralysis of the left side of the body but this cleared up entirely. The second stroke involved the right side and at the time of admission all signs of paralysis had disappeared except on the face. The patient had menstruated regularly up to four months before entry to the hospital. There were no menses after that, and she had never had any menstrual disturbances.

On admission, the patient appeared critically ill. She was markedly emaciated, had a foul odor and was disoriented. The temperature was 98.4° F., the pulse rate was 112, the respiratory rate was 24, and the blood pressure was 160 mm. systolic and 80 mm. diastolic. The right side of the face was paralyzed and the pupils did

not react to light. There was no nystagmus or strabismus. The conjunctival mucous membrane was very pale. The nares were partly occluded with dried blood. The right corner of the mouth drooped and the patient could not (or would not) protrude her tongue very far. The teeth were in an abominable condition. Pressure over the right supraorbital nerve failed to produce a muscular response, thereby indicating a lesion involving the right facial nerve. There were no abnormalities in the neck except an enlarged thyroid. The apex of the heart was in the fifth interspace in the left midaxillary line. The right border of the heart was at the right sternal border and there were systolic murmurs at the apex and at the pulmonic areas. The lungs showed diminished resonance and very shallow breathing.

The abdomen presented an unusual appearance for it was enormously distended and deeply pigmented as may be seen in the illustrations. The skin contained numerous large striae. The distance from the symphysis pubis to the xiphoid process measured 88 cm. (35.2 inches) and the distance from one anterior superior spine to the other was 83 cm. (33.2 inches). In about the center of the huge abdominal dome was a large, lobulated hernia which was very soft and measured about 15 cm.

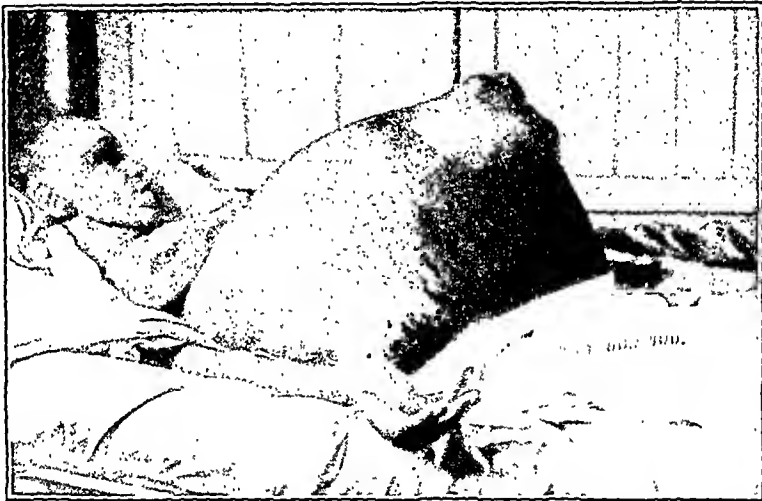


Fig. 1.—Photograph showing distended abdomen, umbilical hernia more clearly and also large striae and emaciation.

(6 inches) in diameter. The top of this hernia included and surrounded the umbilicus. Palpation of the abdomen revealed a few large, hard masses of different sizes, some of which were fixed while others were movable. Percussion and succussion revealed a large amount of free fluid in the abdomen.

On vaginal examination the perineum was found to be markedly relaxed but there was no cystocele. The cervix was so high up that it could not be reached. The body of the uterus likewise could not be outlined. The diagnosis made was "ovarian cyst, multilocular with ascites."

The urine contained 1-plus albumin and a few hyaline casts. Otherwise it was negative. The patient had an outspoken anemia for her red blood count was 1,000,500 and her hemoglobin was 40 per cent. The white blood cell count was 25,000.

On account of the patient's critical condition I of course, deferred operating. The hope was to keep the patient in the hospital for a few weeks and to build up her general condition by various procedures including repeated blood transfusions. However, in spite of our efforts to help the patient she died on October 24 and an autopsy was performed by Dr. R. H. Jaffe to whom I am indebted for the autopsy record (autopsy No. 716). The main interest in this case report centers about the findings in the abdomen. On opening the abdominal cavity there was exposed a



huge, firm mass which on removal was found to measure 40 cm. (16.0 inches) in length, 33.5 cm. (13.4 inches) in height, and 38 cm. (15.2 inches) in width. It measured 116 cm. (46.4 inches) in circumference and weighed 21.4 kilos. (47 pounds). The mass had a smooth, shiny, light, yellowish white surface. Scattered throughout were deep purple-gray and yellow-gray roundish areas each about 2 cm. in diameter. On the anterior surface were many dilated and tortuous veins. To the upper left quadrant of the tumor there were attached several loops of intestines which were very firmly adherent and appeared to be compressed. Numerous small cysts varying from 5 to 20 mm. in diameter were found near the intestinal adhesions and smaller ones were found on the intestines and on the mesentery.

The huge mass was found to be continuous with the posterior surface of the uterus which was compressed low down in the pelvis. The mass extended into the right broad ligament, displacing the ovary considerably. On opening the large mass, about 4 liters of thick, cloudy, dirty, gray-brown, foul-smelling fluid was found in a



Fig. 2.—Cystic fibroid with adherent intestinal loops after removal.

huge central cavity. The wall which surrounded the cavity measured 5.5 cm. (2.2 inches) anteriorly and varied from 3 mm. to 20 mm. posteriorly. It consisted of a rather firm, grayish white tissue. The internal lining of the cyst wall was formed by a dirty gray-brown and gray-green tissue which was covered with membranous tags.

The uterus was 4 cm. long, its wall was 8 mm. thick, and the endometrium was pale. The right ovary measured 4.5 by 2 by 0.5 cm. and the left one measured 3 by 2 by 0.8 cm.

The wall of the cystic tumor was composed of smooth muscle fibers which were arranged in bundles interlacing in various directions. There were areas of edematous loosening of the interstitial tissue and in other places there was much hyaline degeneration. Near the cavity the tissue was more necrotic and large numbers of polymorphonuclear leucocytes were seen in the necrotic tissue.

The other abnormal conditions found at the autopsy are listed in the anatomic diagnosis which was as follows: degenerated fibrocystic myoma of the uterus with

extreme displacement of the abdominal organs, ascending pyelonephritis of the left kidney, slight essential hypertrophy of the heart with brown atrophy and parenchymatous degeneration of the myocardium, slight compression atelectasis especially of the dependent portions of the lower lobes, fibrous adhesions about the spleen and liver, chronic tumor of the spleen with hyalinization of the capsule, slight cloudy swelling of the liver, diffuse colloid goiter, marked decrease in the lipid content and edema of the suprarenal cortex, chronic cholecystitis and cholelithiasis, catarrhal cystitis, multiple subserous fibromas of the fundus of the uterus, atrophy of the uterus, umbilical hernia, and marked emaciation, anemia and hydremia.

185 NORTH WABASH AVENUE.

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## SUBMUCOUS MYOMA COMPLICATING THE PUERPERIUM

A REVIEW OF THE LITERATURE WITH THE REPORT OF A CASE

BERNARD MANN, M.D., F.A.C.S., AND HENRIETTA LOWENBURG, M.D.,  
PHILADELPHIA, PA.

*(From the Department of Gynecology of Mt. Sinai Hospital)*

MANY articles have been written, and textbooks give ample space dealing with the question of myomas complicating pregnancy and labor. Comparatively little has been written concerning myomas and the puerperium, especially the submucous type, due perhaps to the fact that fewer cases come to term, also that patients with submucous myoma are apt to be sterile, and if pregnant, are more prone to abort.

In a recent paper by Watson, giving his experiences of cases in which fibroid tumors of the uterus have presented a problem in relation to fertility, pregnancy, labor, and the puerperium, he does not mention the presence of a submucous fibroma complicating the puerperium, nor does the discussion of his paper elicit the citation of a case.

An interesting case presented itself at the Mt. Sinai Hospital that we felt would be of sufficient interest to report.

H. W., white, aged thirty-two years, placed herself under the care of the senior author (B. M.) from the beginning of her present pregnancy. This was her third pregnancy, the first terminating in an abortion at the end of the second month, and the second in the spontaneous delivery of a normal living child eleven years ago. She began to menstruate at the age of fourteen, always regular, rather free in amount and five days' duration. She had her last menstrual period October 20, 1930, was calculated to be due July 27, 1931. The present pregnancy proceeded uneventfully and labor began at 1 o'clock the morning of August 4, 1931. The patient arrived at the hospital at 3:40 A.M. The uterine contractions were strong, occurring every two minutes and lasting sixty seconds. The membranes had ruptured on the way to the hospital and before the patient could be properly prepared the child was born, weighing 6 pounds, 4½ ounces. One ampule of pituitrin was given by hypodermic injection following the birth of the baby and the uterus seemed well contracted and firm. Examination revealed no laceration. The bleeding was very slight. The placenta was propulsively expelled in thirty minutes, it was carefully inspected and found to be intact. One ampule of gynergen was administered intramuscularly and the uterus contracted firmly, remaining below the umbilicus. The

first hour postpartum the patient oozed a very moderate amount of blood. Four hours after delivery a few larger clots were expelled and after-pains were severe. The uterus continued to be well contracted. After waiting forty-eight hours, during which time she continued to pass clots and complain of after-pains, we decided to explore the uterus.

Under nitrous oxid oxygen anesthesia a hand was introduced into the uterine cavity and a firm, somewhat flattened out globular mass of tissue firmly adherent to the anterior uterine wall was encountered. The tumor was with difficulty shelled away from the uterine wall and extracted in several pieces. An ampule of gynergen

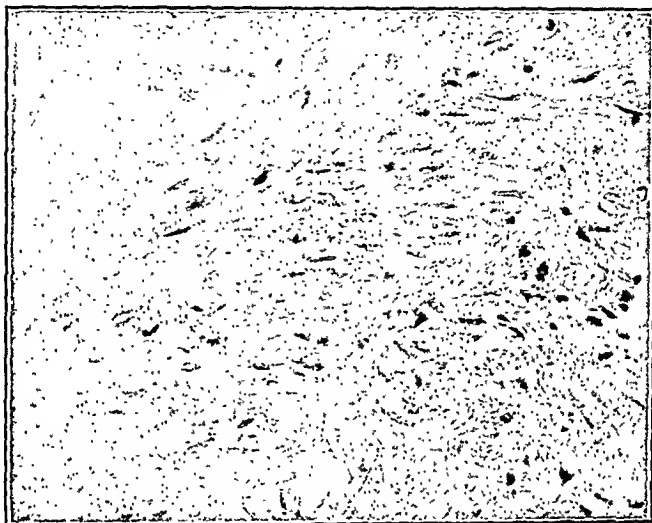


Fig. 1.—Section of myoma showing poorly preserved muscle fibers (high power).

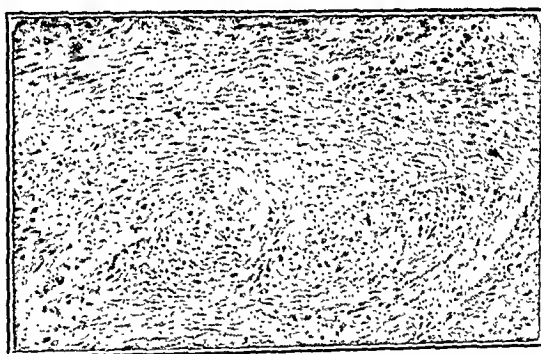


Fig. 2.—Section of myoma showing poorly preserved muscle fibers (low power).

was given intramuscularly. From this time on, all bleeding ceased, and the uterus normally underwent the process of involution. Except for a period of twenty-four hours following the removal of the tissue, when the temperature was elevated to as high as 103° F. She made an uneventful recovery, and was discharged from the hospital the fifteenth day following delivery in excellent condition.

*Pathologic Report.*—The specimens submitted consisted of several large pieces of tissue of irregular outline. The largest measured 13.5 by 9 by 4 cm., and the others, approximately equal in size, measured 8 by 3.5 by 2 cm. All were firm in consistency and were composed of pinkish-white tissue, portions of which were infiltrated with blood. On sectioning some portions of the interior had a grayish cast.

Microscopically the tissue presented was uterine musculature in varying states of preservation. Its fibers exhibited throughout, the hypertrophy incident to the gravid state. Many of them showed vacuolization. In some fields the nuclei and protoplasm stained fairly well but for the most part they stained poorly, indicating a semi-neerotic condition. Large sinuses were present, many of which were filled with blood. No placental tissue was found.

A search through the literature revealed only one such case reported by Gonnet, in Lyon in 1912 of a case of a twenty-year-old primipara who underwent a normal pregnancy and spontaneously delivered a living child. Four hours after delivery the placenta showed no signs of separation. The uterus was firmly contracted and unusually large. A hand was introduced into the uterine cavity and encountered an adherent placenta. In the course of a manual removal the hand came in contact with a hard firm mass which was attached by a pedicle to the uterine wall. The placenta was particularly densely adherent to the mass. After the placenta had been extracted, Gonnet removed the pedunculated tumor from the uterine wall by digital dissection. Pathologic examination proved it to be a submucous fibroma. The patient had an uneventful recovery.

Another case reported by Lepage and Vaudescal in Paris, in 1913, was that of a primipara, who after a twelve hour labor, delivered herself of a living child. The placenta could not be expressed and a hemorrhage occurred, so profuse that a manual separation and extraction was resorted to. A large submucous fibroid was found occupying the posterior fundal portion of the uterine cavity. It was left alone. Several days later the lochia became foul and the patient ran a septic temperature. A subtotal hysterectomy was performed and the submucous fibroid was found to be infected and neerotic. The patient recovered after a stormy convalescence. Spencer reports a patient that bled for eleven days postpartum. The uterus was firmly contracted during this time, but reached a slightly higher level than was considered normal. He also states that the diagnosis of submucous tumors during pregnancy is difficult. During the puerperium it is easier, but even then they may be overlooked.

Hemorrhage is undoubtedly the commonest symptom. Engstrom, Neubner, and Troele have found the placenta firmly adherent to a pedunculated tumor. When separation occurs hemorrhage is inevitable. Glarner and Wertheim have reported postpartum hemorrhages as a result of intramural and sessile growths. Fischmann in summarizing the complications of submucous fibroids during the puerperium names hemorrhage as the most common.

Polak states that some submucous tumors cause no symptoms, but do not involute with the uterus and are extended. With this extrusion Gemmil reported a partial inversion of a uterus. Both Polak and Gemmil report cases that have bled profusely with the delivery of the afterbirth. Pearson, Glarner and Wertheim, Fischmann, Engstrom, Neubner, Troele, and others also believe that intramural and sessile growths as well as pedunculated growths often cause postpartum hemorrhage. When this occurs, all the authors agree that myomectomy should be done immediately.

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## TUMORS OF THE ROUND LIGAMENT

CYRUS F. HORINE, M.D., BALTIMORE, MARYLAND

(From the Department of Surgery, School of Medicine, University of Maryland)

**K.** W., aged fifty-four, married, entered the Provident Hospital July 2, 1929, complaining of a "swelling in the lower part of the stomach." The family history and the past history were negative. The patient started menstruating at the age of thirteen years. Regular periods lasted three to four days without excessive bleeding or pain. Menopause occurred ten years previous to time of admission. She had carried and delivered three full-term babies without instrumentation.

The physical examination was negative with the exception of the presence of a mass in each inguinal region. These masses had been noticed for a period of one year prior to admission. The mass on the right side appeared to be about the size of an English walnut, somewhat movable, and not adherent to the overlying



Fig. 1.—This is a photograph (actual size) of the tumor described in the text.

skin. It was fairly firm in consistency, though apparently cystic. The mass on the left side was not quite so large and not so freely movable as the one on the right side. It was more or less "doughy" in consistency. Operation was advised, after a diagnosis of bilateral hydrocele of the canal of Nuck had been made.

Both masses were exposed through inguinal incisions under nitrous oxide and ether anesthesia. A hydrocele of the canal of Nuck, found on the right side extending down to the fundus of the bladder, was removed *in toto*. The tumor of the left inguinal canal was encapsulated and adherent to the extraperitoneal portion of the round ligament. A slightly transparent capsule made us suspicious of an incarcerated hernia. An incision made into the capsule set free about an ounce of straw-colored fluid. The internal inguinal ring could not be found near the mass which was dissected away from the round ligament and enucleated *in toto*. A careful examination was made to determine the presence of scar tissue between the capsule of the mass and the anterior parietal peritoneum. There was no scar tissue present. The capsule of the tumor was of the same thickness throughout. Fatty tissue resembling omentum was suspended by a pedicle within the capsule. The lining of the capsule had a serous surface resembling peritoneum.

The fatty mass may have been embryonic in derivation or it may have been the

result of an old strangulation of part of the omentum. If its presence was due to an old strangulated omentocele one would expect to find some scar between the capsule and the parietal peritoneum. This, as mentioned above, could not be found.

In addition to this case, we have reviewed 36 cases of the different types of tumors of the round ligament which have been reported since 1914. Prior to 1914, Wells reported 2 cases of fibromyomata in 1865; Saenger in 1882 reported 12 cases of fibromyomata in addition to one case of his own; Emanuel in 1903 collected 80 cases and Taussig found 61 cases of tumor reported from 1903 to 1914, in addition to his own reported case of sarcoma of the round ligament.

I have not included the cases of hydrocele in this group but have included two cases of dermoid cysts, one cystic lymphangioma and another cyst thought to have been tuberculous. Guyot and others reported finding a mass which proved to be an inflammatory lymphatic gland. They mention that the presence of glands on the round ligament near the horn of the uterus appears to be very rare.

The average age in this group is thirty-eight years. The age was not given in five cases. This corresponds to the average age in other reported groups of cases. Winckel found one case in a patient seventy-six years of age, while the youngest reported case has been recorded by Aichel in a newborn child. The youngest case in our group was a child five years of age, reported by Ducuing as having a bilateral lipoma. The oldest case is Gueullette's case of Wolff's tumor in a woman sixty-three years of age. This tumor showed malignant degeneration.

We found 22 cases where the tumor occurred on the right side, while 9 cases were located on the left side, and 2 cases were bilateral. One of the bilateral cases was lipoma and the other fibromyoma. The location was not given in 3 cases. Emanuel's review shows a preponderance of tumors of the right side, while Taussig's report gave almost equal distribution. Ward, Kanther, Vercesi, Sams and Walther reported their cases as having been intraperitoneal.

According to Taussig the symptoms of tumors in this location are very slight. A number of this group complained of pain at the site of the tumor during menstruation.

Broun's case of adenomyoma and Sserdjukoff's case of cystic lymphangioma were given as postoperative cases. Calzavara's case of osseous tumor was thought to have resulted from an old tuberculous infection.

The diagnosis in practically all of this group was made by histopathologic section. The cases are tabulated as follows:

Adenomyoma	4 cases	Fibrosarcoma	2 cases
Cystic Fibroma	1 case	Leiomyoangioma	1 case
Cystic Lymphangioma	1 case	Lipoma	1 case
Dermoid Cyst	2 cases	Lymph gland in ligament	1 case
Fibroma	6 cases	Osscous Tumor	1 case
Fibrolciomyoma	1 case	Sarcoma	2 cases

Fibromyoma	5 cases	Tuberculous Cyst	1 case
Fibromyosarcoma	1 case	Varicosities	2 cases
Fibromyxoma	1 case	Wolff's Tumor	2 cases
Fibromyxoleiomyoma	1 case		

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817 PARK AVENUE.

## A CASE OF ECTOPIA CORDIS\*

CHARLES LINTGEN, M.D., PHILADELPHIA, PA.

*(From the Department of Gynecology, Jefferson Medical College)*

**C**ONGENITAL ectopia cordis may be found in one of several forms. The heart may be displaced to almost any part of the mediastinum or abdomen, or it may be entirely outside of the body. The condition has been conveniently divided into internal and external form depending on the location of the heart.

Mrs. H. M., white, went into labor on the night of January 12, 1932, being admitted to Jefferson Hospital on the following morning. She had a pulmonary tuberculosis in early life, which apparently had become quiescent. No history of abnormalities, either on her own or the husband's side could be obtained. During the second month of pregnancy, she had attempted an abortion by means of quinine and castor oil.

Physical examination was grossly negative. Urine and blood pressure were repeatedly normal, and the Wassermann and the Kahn tests were negative.

Labor pains were not severe, until late afternoon, when rectal examination revealed the head low in the pelvis, the cervix being dilated about two and a half inches. About 10:00 P.M. the nurse reported that the patient vomited with each pain. Upon examination, nothing significant to account for the vomiting could be found, but it was thought possibly adhesions might have developed in some way between the bowel and the fundus of the uterus, contractions of the latter causing tugging on the bowel. The pulse, respirations, and temperature were normal. At 11:00 P.M. the cervix was completely dilated. The patient still vomited with the strong pains. The head, however, seemed to be in the same position as it was four hours earlier. At 11:55 the head delivered spontaneously, but when an attempt was made to deliver the anterior shoulder, abnormal resistance was felt. After it had passed under the symphysis the thorax and abdomen could not be delivered, beyond the umbilicus. At this time, a dark blue mass was noted in the region of the cord, which was manipulated through the dilated cervix. Beyond this mass, could be felt the taut umbilical cord, which was clamped inside the uterine cavity, following which the child was delivered. The placenta was expressed, intact, about five minutes later, by Credé's method, being normal in appearance and weighing 450 gm. The umbilical cord, however, was extremely short, measuring but 10 cm. The cervix and perineum were lacerated. The mother's convalescence was uneventful, and she was discharged from the hospital on the fourteenth day after delivery.

Upon delivery, the child cried, breathed promptly and normally, and the skin was pink in color. Upon the anterior chest wall, in the midline above the epigastrium, was a bluish, pulsating mass about the size of a lemon, readily recognized as the heart, protruding through an opening in the anterior chest wall due to the absence of the gladiolus. The manubrium sterni and the ensiform process were present. Further examination disclosed a craniorachischisis, a club foot (left), bilateral cleft palate, facial hemiatrophy. The child weighed 3 kg. and was 51 cm. in length, appeared active and took several bottle feedings. The heart stopped beating at one time, the injection of a few drops of adrenalin into the muscle causing it to again beat vigorously. Death occurred in twenty-eight and a half hours.

Motion pictures, x-rays, and electrocardiographic studies were made. The latter, reported by Dr. Ross V. Patterson, showed a pulse rate of 150 per minute, with some

\*Read at a meeting of the Obstetrical Society of Philadelphia, May 5, 1932.



slight variation in the rhythm, possibly due to sinus origin. Because of the altered position of the heart, it was impossible to compare it with the ordinary electrocardiogram.

Many cases of ectopia cordis, where the heart was outside the body have been reported by various writers. In a complete review of all the literature, forty-eight distinct cases were found recorded. Space will not permit the citation of all these cases, but the entire bibliography has been retained by the author. Most of these cases are more or less similar to the one here described. In three instances, attempts were made to replace the heart into the mediastinum without success. In the majority of instances reported, the child was either born dead, or died soon after birth.



Fig. 1.

The etiology of the condition is rather obscure, but the consensus of opinion of various authorities seems to be that arrested development at a certain period induced primarily by a pathologic ovum is responsible.

In the case here described, the mother took an abortifacient drug in the early weeks of pregnancy. In cases of threatened abortion, where the ovum has become blighted, abnormalities and monstrosities occur most frequently. We might, therefore, assume that the development of the embryo, by virtue of possible blighting of the ovum, was arrested at a critical period, manifesting itself at full term by the abnormality found.

## INSTRUMENT FACILITATING ATRAUMATIC PALPEBRAL SEPARATION IN THE NEWBORN

MARIO A. CASTALLO, M.D., PROVIDENCE, R. I.

THE difficulty sometimes encountered and the trauma produced in attempting to place "drops" in the eyes of newborn infants has prompted this instrument. The procedure of a doctor or nurse struggling to open the eyes of the newborn infant with gauze and cajoling, or cautiously standing by to catch the baby unawares

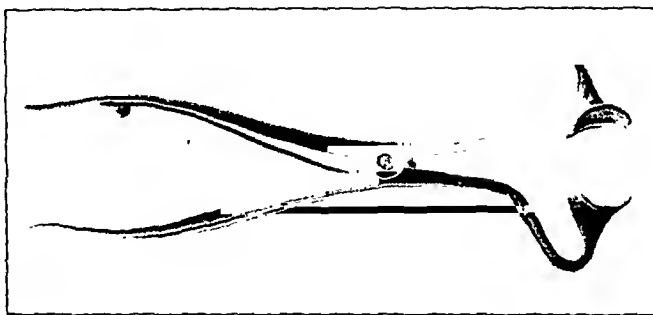


Fig. 1.



Fig. 2.

and then dropping the argyrol or silver nitrate solution into the eyes has always been a most irritating procedure. In addition, many swollen eyelids occur, not to mention the trauma imparted which is at times the starting point for erythema, pustules and other complications.

The eyelid separator presented is easy to operate and to sterilize properly. The ends of the dilators are so fashioned that one cannot, if care is exercised, get the instrument below the eyelids and injure the orbit. The ends of the dilators are inserted under the lids to either side of the palpebral fissure, and with a minimum of pressure the eyelids are opened and are held in that position for as long as the operator desires for the instillation of the medication (Fig. 2).

The instrument has been used with much success and with a minimum of trauma to the eyelids and has been a most welcome addition to the delivery table set-up.

NOTE: The instrument is manufactured by the Fred Haslam Co., Brooklyn, N. Y.  
255 THAYER STREET.

# Society Transactions

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## OBSTETRICAL SOCIETY OF PHILADELPHIA

*MEETING OF MAY 5, 1932.*

The following papers were presented:

**A Case of Ectopia Cordis.** Dr. C. Lintgen, Philadelphia, Pa. (See page 449.)

**A Survey of Cesarean Sections Performed in Philadelphia During 1931.** Dr. C. B. Lull, Philadelphia, Pa. (See page 426.)

**Lesions of the Placental Vessels: Their Relationship to the Pathology of the Placenta; Their Effect Upon Fetal Morbidity.** Dr. T. L. Montgomery, Philadelphia, Pa. (See page 320.)

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## NEW YORK OBSTETRICAL SOCIETY

*MEETING OF MAY 10, 1932.*

Dr. Harry Aranow presented a paper (by invitation) entitled **An Account of a Year's Service in Obstetrics at the Morrisania Hospital: A Public Institution.** (For original article see page 420.)

Dr. W. H. Cary presented a paper entitled **A Clinical Study of 100 Cases of Developmental and Functional Deficiencies in the Female With Analysis of Treatment and Results.** (For original article see page 335.)

Dr. Alfred Plaut read a paper (by invitation) entitled **Ovarian Struma: A Morphologic, Pharmacologic, and Biologic Examination.** (For original article see page 351.)

# Department of Book Reviews

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CONDUCTED BY ROBERT T. FRANK, M.D., NEW YORK

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## REVIEW OF NEW BOOKS

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### ENDOCRINOLOGY

The four volumes on endocrinology reviewed are interesting from the different aspects from which they regard the subject.

Rowe has concentrated on a large number of mainly chemical tests performed on a huge human material which he has, upon purely clinical grounds, divided into arbitrary groups. Mazer and Goldstein, on the other hand, have focused their attention mainly upon the biologic hormonal tests so far available and have limited their discussion to the female. Engelbach's volumes on the other hand, in an uncritical fashion, emphasize the clinical phases of the subject, and focus his attention to the anthropometry, x-ray, and the somewhat doubtful adrenal and pituitrin reactions. The contribution from Hirsch's *Handbuch* is a strictly objective presentation based on morphologic studies.

To judicious readers these books will prove of use, if sufficient eclecticism is exercised in sifting hypothesis and conjecture from actually ascertained facts.

*The Differential Diagnosis of Endocrine Disorders*,<sup>1</sup> by Allan Winter Rowe, is a description of the "vital function tests" which he and his group employ in order to discover individual departure from the normal. The description of history taking, the careful physical examinations and laboratory examinations performed on some 5000 patients would be of inestimable value if I were not obliged to consider the classification into pituitary, thyroid, gonadal, adrenal, and pancreatic groups to be so arbitrary as to rob the statistics of their value.

This does not signify that the physician or even the specialist in endocrinology cannot find much of interest and profit in studying the book, as the investigations are systematic and the clinical methods employed excellent. —R. T. Frank

Mazer and Goldstein's *Clinical Endocrinology of the Female*<sup>2</sup> describes the functional phases of the human female, puberty, menstruation, pregnancy, lactation, and the menopause. Most emphasized in this volume are the various hormonal tests, including the pregnancy test of Aschheim and Zondek, as well as Friedman's, the female sex hormone tests in the nonpregnant female, the prepituitary hormone tests in the blood and urine. The general medical reader as well as the specialist and laboratory worker will find in this volume a very satisfactory, clearcut, well arranged and well balanced description of what we know about female sex physiology, both from the laboratory and clinical standpoint, including the most recent discoveries in this field. Even those not familiar with the subject can orient themselves with readiness and profit. A tremendous amount of material has been incorporated in this book, with readily

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<sup>1</sup>*The Differential Diagnosis of Endocrine Disorders.* By Allan Winter Rowe. The Williams & Wilkins Co., Baltimore, 1932.

<sup>2</sup>*Clinical Endocrinology of the Female.* By Charles Mazer and Leopold Goldstein. Illustrated. W. B. Saunders Co., Philadelphia, 1932.

accessible literature of 649 numbers. The authors are too optimistic as to the results and effects of therapy but in the main have shown commendable reserve. The volume is highly recommended to any one who desires to inform himself upon this important phase of medicine as well as to workers who can use it for reference.

—Robert T. Frank

*Endocrine Medicine*<sup>3</sup> by William Engelbach, consists of three volumes and an index volume, the latter not having as yet been received. The author announces that in the volumes so far published, the suprarenal medulla, the pancreas, and the liver have not been dealt with and have been reserved for a later volume. According to the author, fully 8 to 10 per cent of all patients have some endocrine disorder.

Volume I covers the fundamentals among which he includes the history of endocrinology, organology (comparative anatomy, embryology, and histology), to which only 38 pages are devoted. Physiology including endocrine function, animal experiments, description of hormones, and the autonomic nervous system, are then taken up. Among the etiologic factors, heredity, incidence, age, duration, race, and sex are included. Such extraneous factors as food deficiency, toxemias, emotionalism, the process of reproduction, tumors, and trauma may be of moment.

The diagnostic procedures emphasize anthropometry. Such subjects as the history, the examination and illustrative case reports are then described. Three short chapters deal with basal metabolism, the hormone and the specific reactions, and blood chemistry. The concluding chapters of this volume describe the relation of endocrinopathies to general medicine and their relation to public health.

Volume II deals with infantile and juvenile endocrine diseases, and Volume III with adolescent and adult troubles. This division may be of some utility but it entails endless repetitions in the text, in charts, and illustrations of bone roentgenograms. The text does not lend itself to detailed review. The division in Volume II under infantile disturbances, with minor changes is found in the succeeding subdivisions. It covers thyroid, hypophysis, biglandular (thyroid-pituitary), gonadal disturbances (gonadism, cryptorchism, hermaphroditism), as well as the parathyroid diseases, and again takes up the relation of these to general practice and specialism, as well as to public health.

The practical and theoretical considerations are fully illuminated by a large number of carefully worked out case histories. In these it is apparent that the following are specially stressed—the anthropometric measurements, the basal metabolism, the response to the adrenalin and pituitrin tests, as well as x-rays of the skull and of the extremities.

The author has assembled a large number of instructive tables and charts dealing with measurements and statistics.

The reviewer has found this book difficult to read as the arrangement of the literature which has been studied exhaustively and with great care, is somewhat involved. He has also found that the generalizations are ponderous and difficult to understand. Needless to emphasize, in a book of this size and dealing with the subject still in the state of flux, differences of opinion and interpretation will naturally arise. However, many will certainly disagree with the author's conclusions, Volume II, page 94, that the direct treatment of pituitary disorders of this early age (speaking of juvenile conditions) is also comparatively simple and satisfactory. The growth hormone can be supplied by giving desiccated anterior lobe orally or by injection and its extracts intramuscularly. In my opinion the reason for this apparently ready response to therapy is to be found in the fact that many of these disorders are temporary and self-

<sup>3</sup>*Endocrine Medicine*. By William Engelbach, M.D., F.A.C.P., B.S., M.S., D.Sc. With a Foreword by Lewellys F. Barker. Three volumes and an index volume. Charles C. Thomas, Springfield, Illinois, 1932.

limited. This applies as well to the "thyro-pituitary" group, if such classification is to be used. On the other hand (page 383) Engelbach, in none of 53 cases of hypergonadism in juveniles, found any response to therapy. These cases were only in males. Again the author, third volume, page 200, claims that the available prepituitary preparations contain much of growth and comparatively little of sex hormone. This is quite contrary to my own experience.

The illustrations are numerous (933 in number), well executed, and judiciously chosen from many sources to whom due credit has been given. The typography and format are faultless.

Since this review was written Dr. Engelbach has died of heart disease.

—Robert T. Frank

The 6th installment of the first volume of Hirsch's *Handbuch der inneren Sekretion*<sup>4</sup> contains valuable contributions on the hypophysis and a short article on the epiphysis. Benda of Berlin discusses the anatomy, topography and histology of the gland. His contribution is brief but accurate and careful. The article on the pineal is likewise a contribution from the same author who has meanwhile died.

Berblinger of Jena likewise has two contributions. The first one deals with the pathology and the pathologic morphology of the human hypophysis. He takes up the changes observed especially when there are disturbances of function of the gonads, thyroid, and adrenals. The normal constitution of the hypophysis is chromophobes 52 per cent, acidophils 37 per cent, basophils 11 per cent, but with considerable variations above and below these limits. In castrates there is a great increase of eosinophils. In pregnancy and athyrosis there is an increase in the chief cells. Adrenal insufficiency appears to cause a diminution in basophils, while in diabetes mellitus the eosinophils are decreased. Furthermore, in two-thirds of the renal nephritics, the basophils are increased. This discussion is extremely careful with good illustrations and a thorough inclusion of the European literature.

Among the diseases, acromegaly, pituitary gigantism, Simmond's disease (ascribable mainly to inflammatory causes) as well as nanism are taken up. The complex described by Brugsch as "acromicrie" and also known as dystrophia osteogenitalis, is gone into in considerable detail, the symptoms being loss of hair, thirst, headaches, amenorrhea, and acrocyanosis of the fingers. Among other diseases described are dystrophia adiposogenitalis of Froehlich, acromegaly, and pituitary tumors. The question of the importance of the hypophysis in diabetes insipidus is discussed and left open.

—Robert T. Frank

## OBSTETRICS

In the *Practical Medicine Series*,<sup>5</sup> obstetrics, as before, is edited by DeLee and gynecology by Greenhill. As usual the volume contains careful abstracts of innumerable and important articles. They are suited to every taste. Both the general practitioner and obstetrician and gynecologist can find articles that he may have overlooked in the study of the year's literature. The value of this publication lies particularly in being able to see important groups of cases and important subjects assembled. Such individual facts as pregnancy at advanced age, pregnancy tests in normal pregnancy and in chorionepithelioma, the effects of thymophysin may be mentioned. DeLee is strongly opposed to the use of pituitrin during labor. The many articles on cesarean section are accompanied by a warning of the extreme dangers of this operation as shown by the statistics gathered in the United States. Among the other obstetric subjects, the puerperium and puerperal sepsis are featured.

<sup>4</sup>*Handbuch der Inneren Sekretion*. Herausgegeben von Dr. Max Hirsch. 1. Band. Lieferung 6. Curt Kabitzsch, Leipzig, 1932.

<sup>5</sup>*Practical Medicine Series*. Obstetrics edited by Joseph B. DeLee. Gynecology edited by J. P. Greenhill. Series 1931. Year Book Publishers, Inc., Chicago, 1932.

In the gynecologic section, sterility is discussed, with the many tests now practiced to determine its mechanical basis. Operations for the correction of uterine position, still play a rôle. The operations for birth injuries are reviewed. Considerable space is devoted to the physiology of menstruation and its disorders. Some space is devoted to the glands of internal secretion. Tumors of the genital tract, electro and radiotherapy conclude this valuable volume.

—Robert T. Frank

The book is one of the "recent advances" series, and to a very great extent justifies its title. It is written in a clear and concise style, easily and quickly readable. The obstetric division is well handled and for this alone it should be exceedingly useful. The statistics on maternal mortality in England are presented, and the methods advanced for their improvement are praiseworthy. There is also a relatively extensive chapter on the causes of fetal deaths both neo- and postnatal, well worth reading, as well as one equally as good on the recent advances in the chemistry of the parturient. Antepartum hemorrhage, the toxemias, cesarean section and puerperal infection are simply and sanely discussed. Statistics wherever available are given to support modern views. As can be readily seen there is overwhelming emphasis on prophylaxis in obstetrics.

The gynecologic division of the book does not receive as adequate treatment. The methods used in the therapy of cancer of the cervix, of which there has been considerable recent discussion, are statistically compared. The importance of tubal insufflation in the handling of the sterile woman is shown and several types of plastic operations on the tube are described. Sampson's work on endometrioma and Shaw's on "metropathia hemorrhagica" are extensively gone into. Two somewhat overenthusiastic chapters on physiotherapy and the use of x-rays in gynecology written by Wilson and Gage respectively are appended. The description of the sex hormones is adequate.

As has been said this book is valuable. For those who prefer not to consult the literature it should prove to be a welcome addition to the library.

—Frank Spielman

The author discusses in the first part of this small monograph the collective opinions of previous investigators regarding the *regulatory mechanism of the acid base balance in pregnancy*. He expresses the view that these presentations have led to the idea that a pregnancy acidosis can be demonstrated as a physiologic appearance, consequent upon an increase of the weak fixed acids in the blood, and that during pregnancy a series of regulatory influences arise to compensate for this increase.

In the second part of the monograph he describes his theories regarding the cause of the physiologic pregnancy acidosis and of his examinations regarding the disturbances in the acid base balance in the toxemias of pregnancy. In his research he has used an electrometric titration of the weak acids in a serum filtrate. Although previously used in biology this is the first time that the method has been used to establish, in a direct quantitative manner, the weak fixed acids of the blood in an investigation of the question of pregnancy acidosis.

He concludes that a change in the function of the glands of internal secretion, a hyperfunction, apparently is responsible for the physiologic acidosis of pregnancy. This theory he feels is supported through investigation of the blood in exophthalmic goiter.

In hyperemesis gravidarum a moderate increase in the amount of fixed acid in the

<sup>6</sup>*Recent Advances in Obstetrics and Gynecology*. By Aleck W. Bourne, and Leslie H. Williams. 1932, 418 pages. F. Blakiston's Son & Co., Philadelphia, Pennsylvania.

<sup>7</sup>*Die Regulation des Säure-Basen Haushaltes in der Schwangerschaft und ihre Störungen bei den Schwangerschaftstoxikosen*. von Dr. Karl Julius Anselmino, Privatdozent für Geburtshilfe und Gynäkologie an der Medizinischen Akademie in Düsseldorf. Seite 75, Mit 11 Abbildungen. Berlin, S. Karger, 1932.

blood is present. In all the cases of nephropathies of pregnancy which the author investigated he found a tendency toward a lowering of the acid content of the blood. In eclampsia, in a great majority of cases, there was only a moderate increase in the fixed acids of the blood, except in the fatal cases where at times higher amounts were reached. There appeared to be no relationship between the degree of blood chemistry alterations and the severity of the clinical symptoms. —Philip F. Williams

Olin has described, *Studien über die Veränderungen der Nachgeburt bei Lues*,<sup>8</sup> the changes in the placenta noted in syphilis. He bases his material on 39 cases. The monograph appears as a reprint from the *Arbeiten aus dem Pathologischen Institut der Universität Helsingfors* (Finland). It is adequately illustrated by microphotographs.

The main conclusion arrived at is that the average weight of the placenta in cases of lues in which the child is born at term, shows no increase and consequently the weight of the placenta cannot be considered of diagnostic value. In the placenta there are no pathognomonic histologic criteria except the finding of the spirochetes. It is true that in syphilitic placentae certain changes which are rare in normal cases, occur with greater frequency but are not distinctive of syphilis. These include granulocytic infiltrations in the decidua basalis, the typical villous hyperplasia, in a form resembling miliary abscesses as well as obliteration of the villous vessels. The vessels of the cord frequently show granulocytic infiltrations in their walls or in Wharton's jelly. These changes, while suspicious of syphilis, do not assure the diagnosis. It is difficult to find spirochetes in the placenta, resembling their infrequent presence in gummatous lesions. Antisyphilitic treatment given during pregnancy appears to inhibit the formation of these histologic changes to a great degree.

This monograph with its large bibliography should prove of value.

—R. T. Frank

Hüssy's book, *Der geburtshilflich-gynackologische Sachverständige*,<sup>9</sup> dealing with the obstetrician and gynecologist as an expert witness, treats mainly of the aspects of the Swiss law. It covers the important questions which arise, including the diagnosis of pregnancy and puerperium, virginity, puberty, duration of pregnancy, criminal abortion, infanticide. In the gynecologic section, abortion and trauma, and the effect of trauma or accident upon the changes in position of the uterus are dealt with. In an appendix the legal indications for induction of abortion, the questions arising from the duties of physician toward his patient, versus those toward the community, etc., are taken up.

—Robert T. Frank

This is a large work, *Tratado de Obstetricia*,<sup>10</sup> covering most of the obstetric field. It begins with a laudable short history of the development of this branch of medicine before taking up the subject proper. Most of the material is well handled and fully described, although the arrangement of the chapters shows some lack of coordination. Pathology is stressed throughout the book, but it is hard to understand how a work of this magnitude can have omitted a clear and comprehensive chapter on prenatal care. Also, as this is the sixth edition, more careful revision might have brought the book up to date. As examples there may be cited the omission of the important work of Corner in the chapter on physiology, which would have eliminated much of the discussion on the relationship between the corpus luteum and the fertilized ovum; and in the chapter on pregnancy tests, the omission of the Friedman test with the inclusion of numerous obsolete tests. The work also could well do without such therapy as the

<sup>8</sup>*Studien über die Veränderungen der Nachgeburt bei Lues.* Von T. E. Olin. Assistent der dermatologischen Klinik in Helsingfors. Gustav Fischer, Jena, 1931.

<sup>9</sup>*Der geburtshilflich-gynackologische Sachverständige.* von Dr. Paul Hüssy, Privatdozent. Hans Huber, Bern-Berlin, 1931.

<sup>10</sup>*Tratado de Obstetricia* (Spanish). By Sebastian Recasens. Sixth edition. 2 volumes. Salvat Editores, Barcelona, Spain.



use of drugs on a "similia similibus curantur" basis. Some mention of the fact that the Schultze and Byrd methods of resuscitation of the newborn are undesirable might have been made.

On the other hand, such chapters as those on obstetric anesthesia, monstrosities, deformities of the pelvis and the operative field are worthy of praise. The chapter on monstrosities is especially thorough. The author has used pernocton as an anesthetic and has improved his results by combining it with luminal.

On the whole, as a text and reference book, the work should be extremely useful. Much material may be found in it not usually included in the average textbook. The illustrations are adequate.

—Frank Spielman

Liepmann and Danelius in this beautiful atlas of roentgenograms present their views regarding the mechanics of birth and collateral subjects as disclosed by radiography. Following a brief historical sketch of the subject they discuss the technic which they use in the Frauenklinik "Cecilienhaus," the normal position and attitude of the fetus in pregnancy, the changes caused by such factors as the size, the position of the woman, and the muscle tone of the uterus. Anomalies of fetal position and presentation in pregnancy and in labor and their spontaneous correction during birth are shown in serial roentgenograms.

The authors consider the most important use of roentgenograms in obstetrics to be the demonstration of pelvic deformities and the roentgenologic measuring of such pelvises. The axial method of Martins, the lateral method of Guthman and the stereoscopic method are described and discussed at length. The technic, the advantages, and the limitations of all three are given. Liepmann advises that every obstetric clinic, with a large amount of material, should have an easily available roentgenologic department and that many more cases should be subjected to this type of study than heretofore. In the Frauenklinik "Cecilienhaus" all three methods are in common use and from a combination of the findings an exact knowledge of the obstetric situation present is easily obtained.

Many of the common errors in the estimation of pelvic capacity are explained and formulae are given for geometrically ascertaining various measurements. Fetal abnormalities and signs of fetal deaths as portrayed by the roentgenograms are discussed in detail. The mechanism of birth as shown by the roentgenograms supports the theory of Sellheim, to whom, it may be mentioned, this book has been dedicated on his sixtieth birthday. The various mechanisms of the third stage of labor have been shown by injecting the vessels of the cord, immediately after the severance of the child, with an opaque medium.

With the subject handled largely from the practical standpoint, this monograph with its profusion of roentgenograms should make a special appeal to obstetricians.

—Philip F. Williams

The increasing interest in maternal welfare in the past two decades is manifest in the number of publications which have appeared on prenatal care. It has remained for Dr. Irving to strike a happy medium between the insurance company or government pamphlet and the miniature textbook on obstetrics, and to give us a satisfactory *Handbook for the Expectant Mother*.<sup>12</sup>

Here the fundamental facts of reproduction are presented in an easily understand-

<sup>11</sup>Geburtshelfer und Röntgenbild, Erweiterung und Erneuerung der Geburtshilfe durch die Röntgendiagnostik. von Univ. Professor Dr. Wilhelm Liepmann, Direktor des Deutschen Instituts für Frauenkunde und der Frauenklinik "Cecilienhaus," Berlin, und Dr. Gerhard Danelius, Assistenzarzt am Strahleninstitut des "Cecilienhaus." Seite 262; 160 Abbildungen. Berlin und Wien, Urban und Schwarzenberg, 1932.

<sup>12</sup>The Expectant Mother's Handbook. By Frederick C. Irving, A.B., M.D., Professor of Obstetrics, Harvard Medical School, Visiting Obstetrician, Boston Lying-in Hospital. Pp. 200; 26 Illustrations. Houghton Mifflin Company, Boston and New York, 1932.

able form and oft repeated superstitions dispelled. The rules for prenatal hygiene are clear and simple and thoroughly explained. The woman is plainly told the cause of some pathologic conditions and the significance of warning symptoms of approaching danger. The process of childbirth is made clear to the intelligent woman without creating any fear or mystery about it. The average woman will be glad to read a discussion on obstetric analgesia and anesthesia which the lay writer so often luridly portrays for her. The chapters on the puerperal period and on the newborn are excellent.

This book may be highly recommended with the feeling that the reading of it by a pregnant woman will make her a more cooperative and understanding patient.

—Philip F. Williams

## GYNECOLOGY

The author has the fortunate qualification in writing this book, *Physikalische Therapie der Frauenkrankheiten*,<sup>23</sup> in that he has been engaged not only clinically in gynecology and obstetrics but also personally active in roentgenology at the same time. In the opening chapter on the influence of radium and roentgen rays upon the body the author is of the opinion that the deleterious effect on pregnancies subsequent to the raying is exaggerated. The psychic and vasomotor symptoms of the artificial menopause he states are five times as frequent in women under forty years of age castrated by the roentgen ray as compared with those undergoing bilateral oophorectomy at operation.

The direct and indirect effect of artificial light therapy in various gynecologic conditions includes mention of the markedly beneficial effect of such therapy upon pre-eclampsia. The various methods air, water, light and electrical conduction of applying heat in gynecologic conditions are presented. The author, seemingly, is not convinced that the gonococcus can be killed by diathermy in the human body through elevation of the temperature to a lethal degree for bacteria. Nor does the author feel that massage and electrotherapy, galvanic or faradic, offer much aid.

In the second part of the book particular gynecologic conditions are considered one by one with full consideration of the help one may expect from physical methods, and with much attention to detail in technique and dosage. Of particular interest is the discussion of cervical carcinoma. In Budapest operability is low, and operation is reserved for those cases suitable for vaginal hysterectomy (Schauta). The abdominal route is exceptionally used and only for cases complicated by pregnancy or other conditions. Pre- and postoperative deep roentgen raying is customary in the operable cases. In the nonoperable cases massive doses of radium are never used, reliance being placed upon the supplementary effect of roentgen therapy to a moderate dose of radium.

In an equally comprehensive consideration of myoma the author refers to the increasing number of such tumors treated by radiation, with a declining indication for operation. The applicability of roentgen ray to pituitary, spleen, thyroid and ovarian exposure, in amenorrhea, sterility and disorders of menstruation is sharply limited. Inflammations of the pelvic organs present, according to the author, a wide field for the use of physical methods. In the clinic at Budapest, from which the book emanates, a most conservative attitude is held, even to the point of temporary castration, by the roentgen ray in adnexal disease, to give a prolonged rest period from cyclical activities.

The final chapters describe the technique of the physical methods previously discussed with dosage tables for radium, formula for superficial and deep roentgen ray therapy, and light and diathermy machines.

<sup>23</sup>*Physikalische Therapie der Frauenkrankheiten. Kurzes Lehrbuch für praktische Ärzte mit besonderer Berücksichtigung der Indikationen* Von Privatdozent Dr. Felix Gál, Leiter der Strahlenabteilung der II. Universitäts-Frauenklinik in Budapest. Mit einem Vorwort von Prof. Dr. Stephen v. Tóth, Direktor der II. Universitäts-Frauenklinik in Budapest. Seiten 234; Mit 67 zum Teil farbigen Abbildungen. Berlin and Wien, Urban und Schwarzenberg, 1932.

This exposition of the uses of physical methods in gynecology is so complete in both the clinical and technical aspects of the subject that it should be extremely useful not only to the gynecologist, but also to the roentgenologist and physiotherapist.

—Philip F. Williams

This compact *Synopsis of Gynecology*<sup>44</sup> is a miniature textbook. Here the medical student will find a very concise and definite presentation of the subject. The consideration of the general principles, including treatment, is so comprehensive that the book will be quite satisfactory to a large group of the profession who do not specialize in gynecology yet need a working guide for the proper care of their patients.

—Philip F. Williams

Daniel's monograph on *Genital Tuberculosis in Women*<sup>45</sup> appears as one of the monographs edited by Sergeant, Mignot and Turpin in their series, "La Pratique Médicale Illustrée." It gives a thorough insight into all forms of genital tuberculosis. His personal material consists of 155 abdominal cases in which genital tuberculosis was noted in 5. The monograph contains nothing new but is thorough, well written and well illustrated, mainly with illustrations obtained from standard sources. Among the laboratory tests for determining the presence of tuberculosis, Calmette's ophthalmic reaction is mentioned. The author emphasizes that the rare cases of postmenopausal tuberculosis give symptoms, especially uterine bleeding, resembling that seen in fundal carcinoma. Daniel advocates operation in the majority of cases in preference to the nonoperative modes of treatment.

—R. T. Frank

Moulouguet, in the second part of the *Female Genital Tract*<sup>46</sup> begins with functional conditions of the ovary and uterus which he calls "dystrophies." His subdivision of follicular cysts, based on the hormone contents, is worth emphasizing.

The author then takes up benign and malignant uterine neoplasms. His description of fibroids is detailed and clear. In a short discussion of the treatment, no mention of the fibroids requiring no intervention is made. Under malignant cervical lesions some extremely interesting adenomata and leucoplakia of the cervix are described. The description of sarcoma of the uterus is somewhat short.

A number of interesting cases of fallopian carcinomata are given. An excellent series of chapters on tumors of the ovary and broad ligament then follow. Pseudomucin cysts are called "enteroid" because of their enzymic contents of invertin which the author says is strictly limited to entodermal tissues (intestinal tract). Such rare conditions as ovarian seminoma and folliculoma are fully described on the basis of an apparently large material (8 folliculomata). Considerable space is likewise devoted to endometriosis.

This book will prove of great interest to gynecologists and pathologists, particularly because of the large number of excellent illustrations of rare conditions. Operative technic is not discussed in this survey. A real lack will be found in the fact that no statistics of the frequency of occurrence of any of the conditions described has been given.

—R. T. Frank

Roberts' short monograph on *Prolapse of the Female Pelvic Viscera*<sup>47</sup> has as its basic theme a careful dissection of the cellular tissues of the female pelvis situated

<sup>44</sup>*Synopsis of Gynecology*. By Harry Sturgeon Crossen, M.D., F.A.C.S., Professor of Clinical Gynecology, Washington University Medical School, and Gynecologist in Chief to the Barnes Hospital, and Robert James Crossen, M.D., Instructor in Clinical Gynecology and Obstetrics, Washington University School of Medicine. Pp. 220; 110 Illustrations. The C. V. Mosby Company, St. Louis, 1932.

<sup>45</sup>*La Tuberculose Génitale de la Femme*. Par Constantin Daniel. G. Doin & Cie, Paris, 1932.

<sup>46</sup>*Les Diagnostics Anatomico-Cliniques de P. Lecène Appareil Génital de la Femme (Seconde Partie)*. Par P. Moulouguet. Masson & Cie, Paris, 1932.

<sup>47</sup>*Recent Work on Ptosia (Prolapse) of the Female Pelvic Viscera*. By E. Hesketh Roberts. Dickson and Scudamore, London, 1931.

above the levator diaphragm and those portions anteriorly which support the hiatus left by the levator. The structures in question have been renamed by the author, the "meso-vesico-müllerian suspensory tissues" or the "myo-fibro-mesial tissues." In an appendix some instructive roentgenographs with the barium filled bladder, are given in the prone and standing posture. It appears that the author's description of the "suspension support" in the region of the supravaginal cervix and fornices does not differ greatly from that of all recent investigators.

—Robert T. Frank

A committee of the American Gynecological Society has prepared *A Syllabus of Lectures on Gynecology for Nurses*<sup>18</sup> which is a companion volume to a similar syllabus on obstetrics issued some years ago. The framework of the nine lectures into which the material is divided permits for easy expansion or necessary alterations to meet local needs by the instructors. It also lends itself to supplementary teaching by lantern slides or blackboard illustrations. The text is sufficiently complete to be utilized as a textbook by the nurse in training. Sponsored by such an authoritative group the syllabus merits wide adoption.

—Philip F. Williams

### MISCELLANEOUS

Cannon's book, *The Wisdom of the Body*,<sup>19</sup> is designed for the general reader, but the medical man and biologist will find much of interest in its pages. The title used by Cannon was adapted from the title of one of Starling's orations. Cannon emphasizes the word "homeostasis" as a condition which may vary, but which is relatively constant. In the main, the subject matter is based on researches coming from the Harvard group but naturally the world's literature is likewise utilized.

Homeostasis of blood sugar, blood proteins, blood fat, and blood calcium, as well as neutrality of the blood are some of the main topics. The rôle of the sympathico-adrenal system in maintaining balance, is somewhat overemphasized. This book gives an excellent survey of modern viewpoints of the physiologist, admirably expressed, so that any educated person should be able to grasp its contents without difficulty.

—Robert T. Frank

The eugenic, social and therapeutic values of human sterilization laws are treated exhaustively in this study, *Human Sterilization*.<sup>20</sup> The author's interest in the subject was created by the decision of the United States Supreme Court in the *Bill v. Buck* case which upheld the Virginia human sterilization law. The present volume represents his researches into this recent procedure for the many eugenic people in our midst, comparing the merits and demerits of segregation against human sterilization as a social therapeutic agent. The result of this inquiry forms a very scholarly and scientific treatise, handled without any evidence of bias or prejudice.

It is remarkable that in the twenty-five years of the movement, legislation regarding human sterilization has been adopted in 27 states, but of the millions of eugenic people only some 12 thousand have been subjected to legal sterilization, under the existing statutes, and over half of these in California. There is a comprehensive review of the relation of eugenics and social legislation. The second part of the book reviews the three landmark legal decisions on human sterilization, and the present legal status of our human sterilization laws.

The influence of heredity in continuing the various traits of the many types of dysgenic people, mental diseases, deficiencies, and the heredity of psychotic traits, is

<sup>18</sup>*A Syllabus of Lectures on Gynecology for Nurses.* Prepared by a Committee Appointed by The American Gynecological Society, 1932. Copies may be obtained from Dr. Emil Novak, 26 East Preston St., Baltimore, Md.

<sup>19</sup>*The Wisdom of the Body.* By Walter B. Cannon. W. W. Norton & Co., New York, 1932.

<sup>20</sup>*Human Sterilization. The History of the Sexual Sterilization Movement.* By J. H. Landman, Ph.D., J.D., J.S.D. The College of the City of New York. The Macmillan Company, New York, 1932.

thoroughly examined. In a critique of eugenics the futility of human sterilization is suggested in a question as to whether the apparent mental subnormal or the latent carrier of the mental subnormality is to be sterilized. The author feels that human sterilization, as a social program, requires more scientific evidence in its favor.

The surgery of human sterilization takes up the possible methods of prohibiting conception. With the detail characterizing the book the author discusses several biologic methods, hormone, spermatoxin and insulin. The motivation of the movement is dispassionately discussed. The chapter on the administration of such laws shows not only the practical side of the question, but the many impracticabilities and technicalities of their enforcement.

This volume is complete and informing, well documented, and a valuable reference work for those whose work brings them into the slightest medical, social, or judicial contact with the problem of eugenicity.

—Philip F. Williams

"The central motive of this book" has been simply to give to the reader a sufficient background of knowledge to encourage him or her to take advantage of the services of physicians rather than depend upon unreliable and sometimes dangerous popular nostrums." The author, a layman, who has conducted a general orientation course for years on the subjects of sex hygiene and marriage has informed himself thoroughly on the physiologic, psychologic and sociologic angles of the problems connected with these two subjects.

The medical collaboration on the book has been incorporated with discernment. The attitude of modern society toward sex questions and moral equations reveals a full knowledge on the part of the author as to the broad social and economic phases of the topics discussed. The first nine chapters lead inevitably to the chapter on the need for birth control. Here the many arguments in support of a widespread diffusion among all grades of society of effective contraceptive methods are set forth most convincingly.

The present legal status of the dissemination of information regarding birth control, here and abroad, shows that 25 states in our country have no laws mentioning the prevention of conception. The two final chapters list the organizations engaged or interested in birth control, with street addresses of individual clinics, and a discussion of the different methods of contraception. A final reference note at the end of the book mentions the apparent admission of the morality of birth control in principle by the Roman Catholic Church.

The book presents many statements otherwise found scattered in books probably not accessible to the author's audience or students, a concise unobjectionable presentation of sex hygiene and the marriage relation, and an able case for wide dissemination of contraceptive knowledge. The central motive of the book will probably be achieved.

—Philip F. Williams

Various plastic operations on the breast are presented in this small brochure, *Die Formfehler und die Plastischen Operationen der Weiblichen Brust*.<sup>22</sup> The author regards many cases of errors in configuration of the mammary glands as evidence of an underlying disease. For instance, the sagging breast is an expression of the connective tissue weakness seen also in other parts of the body in gastroenteroptosis, retroflexion or prolapsed kidney. The hyperplastic breast is regarded as an expression of a general fat dystrophy. Asymmetry is significant at times of lung tuberculosis. To correct the cosmetic errors in such deformities the author has outlined various operations suitable for the different conditions, describing the methods of Lotsch, Lexer, Joseph, Sellheim and various procedures which he himself has devised.

—Philip F. Williams

<sup>22</sup>*The Hygiene of Marriage*. By Millard S. Everett, Ph.D., Central Y. M. C. A. College, Chicago. The Vanguard Press, New York, 1932.

<sup>23</sup>*Die Formfehler und die Plastischen Operationen der Weiblichen Brust*. von Dr. Erna Gläsmser. Seite 89; 48 Abbildungen. Stuttgart, Ferdinand Enke, 1930.

This little book of *Radiologic Maxims*<sup>22</sup> gives information in short, concise paragraphs. Most of the material offered is well established. There is a tendency to dwell on the importance of radiology to the physician rather than the radiologic field itself. Numerous excerpts to show its importance are quoted from the publications of authorities. Its value to the radiologist is problematical.

—Frank Spielman

Winter's widely known book on the *Indications and Methods of Artificial Abortion*<sup>24</sup> has appeared in a second edition, thoroughly revised with the aid of Professor Naujoks. The first and largest part of the volume is occupied by a critical analysis of all the various medical indications for artificial interruption of pregnancy, beginning with a clear exposé of the ever complex problem of the toxicoses. Opinions of many writers are freely quoted but one readily notices that Winter and Naujoks themselves stress the greater weight of clinical conditions in the individual case over standard rules or mere laboratory findings. All the diseases more commonly met as complications of pregnancy are carefully discussed and proper emphasis placed on facts more recently revealed, such as recognition of fetal malformation by means of radiograms, the likelihood of deleterious effect upon the fetus in utero as result of heavy, therapeutic radiation unwittingly applied in the course of pregnancy.

Among social indications for artificial abortion the writers are willing to admit only: the necessity of heavy work, impossibility of sufficient rest, undernourishment, emotional strain and similar factors which inevitably would seriously aggravate a disease complicating the pregnancy. Therefore, under such conditions the obstetrician is morally obliged to consult an expert internist. For the authors, purely social considerations could never justify abortion, simply because the existing laws forbid it.

Eugenistic indications, at least theoretically, would seem plausible, but actually do not exist for the individual case because human genetics up to now have failed to establish any basis for a definite prognosis in regard to the child for any specific instance.

A short chapter dealing with the laws of Church and State makes interesting reading.

The volume closes with a discussion of the various methods of artificial termination of pregnancy. Drugs taken by mouth always are uncertain in effect. Roentgenisation of the pregnant uterus has its evident drawbacks. All intrauterine manipulations, and among them particularly the more recently advocated injection of salve, favor infection. Curettage is convenient but useful only in very early pregnancy. Preliminary laminaria dilatation of the cervix can be rendered fairly safe by extreme care in technique. Forceful dilatation of the cervix with instruments favors lacerations and even perforation. The last mentioned injury certainly is more common than generally suspected. Digital removal of fetus and placenta after appropriate cervical dilatation is the safest method. The ovum is loosened and then its expulsion aided by compression of the uterus. Only if the presence of rests of the ovum has been definitely ascertained, Winter's abortus forceps can be employed. For far advanced pregnancy metrorrhysis or vaginal hysterotomy are recommended. For some cases an abdominal cesarean section must be considered.

To those familiar with the first edition it becomes evident that Winter in spite of the present prevalence of more radical views and in the face of a very active propaganda for liberalization of existing opinions concerning the justification of abortion, still maintains his rather conservative but entirely fair and sane attitude in regard to the right of the obstetrician to terminate a pregnancy.

—Hugo Ehrenfest

<sup>22</sup>*Radiologic Maxims*. By Harold Swanberg. 127 pages. Radiological Review Publishing Company, Quincy, Illinois, 1932.

<sup>24</sup>*Der Künstliche Abort. Indikationen und Methoden*. By Von Prof. Dr. Georg Winter und Prof. Dr. Hans Naujoks. Zweite vollständig umgearbeitete Auflage. Verlag von Ferdinand Enke, Stuttgart, 1932.

## Item

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### AMERICAN BOARD OF OBSTETRICS AND GYNECOLOGY

The next general, clinical examination of the Board is to be held in Milwaukee on Tuesday, June 13, 1933, immediately preceding the annual session of the American Medical Association. Reduced railroad rates will apply.

The annual dinner and Round Table Conference will be held at the Hotel Schroeder, 7 P.M. on June 14. A short address will be made by one or more of the Board officers and a general discussion of Board activities will follow. All Diplomates of the Board are urged to attend and to bring any interested guests. The subscription for the dinner will be nominal and reservations may be made in advance through the office of the Secretary.

For further information and application blanks address the Secretary, 1015 Highland Building, Pittsburgh, Pennsylvania.

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## Original Communications

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### THE VOLUMETRIC DETERMINATION OF AMNIOTIC FLUID WITH CONGO RED\*

#### A PRELIMINARY REPORT

WILLIAM J. DIECKMANN, B.S., M.D., AND M. EDWARD DAVIS, B.S., M.D.,  
CHICAGO, ILL.

*(From the Department of Obstetrics and Gynecology, the Josiah Macy, Jr., Foundation,  
University of Chicago and the Chicago Lying-in Hospital and Dispensary)*

THE quantitative variability of the liquor amnii is of considerable clinical importance. The average amount of fluid occurring in patients at term has been determined by several investigators by collecting the fluid at the time of delivery. Lehn, in 1916, reported 1200 c.c. as the average amount of fluid in a multipara, compared with 1000 c.c. in a primipara. This difference is ascribed to the fact that multiparae carry their babies longer and, therefore, accumulate more fluid. This explanation is entirely inadequate.

Individual variations in the amount of fluid may be very marked, and a quantity greater than two liters is usually considered excessive. Minor degrees of hydramnion are common, although marked degrees are rare. Küstner has reported 15 liters and Schneider has observed 30 liters at the sixth month of pregnancy. A marked diminution in the amount of fluid is of less common occurrence. Taussig reports a case in which there was less than an ounce of thick, viscid fluid. It has been observed, clinically, that there are variations in the amount of fluid in the same patient at various times. A moderate polyhydramnion has been noted gradually to disappear, so that at term there was present only the normal amount of fluid.

We have been interested in finding a method to determine the amount of liquor amnii in utero without disturbing the pregnancy, so that these quantitative variations could be studied. Such a method would establish

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\*Read before the Chicago Gynecological Society, June 17, 1932.

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NOTE: The Editor accepts no responsibility for the views and statements of authors as published in their "Original Communications."



the normal amount of liquor amnii during the last trimester, would determine the rate of increase or decrease in amount, and perhaps throw light on the factors controlling the formation and accumulation of the fluid. The dye method has been used successfully in the colorimetric determination of the quantity of circulating blood, so we decided to apply this method to our study.

The dye method was introduced by Rowntree, Keith and Geraghty for determining plasma and blood volume. As applied to the quantitative measurement of the liquor amnii, it involves the introduction into the amniotic cavity of a nontoxic, nonabsorbable dye. The dye remains in the uterus long enough to be thoroughly mixed and its concentration in the amniotic fluid is then determined colorimetrically by comparison with a suitable standard mixture of dye and fluid. We make use of Congo red because this dye has been used extensively in work on blood volume. It may not be the best dye available, and we are at present making use of other nontoxic dyes to find the best suited for this work.

#### METHOD OF COLLECTING FLUID

The vaginal route was at first considered to be the best because of the relative safety of any procedure by this route. Culdesac puncture is usually a harmless procedure. With a good aseptic technique, puncture of the uterine cavity through the culdesac or by way of the anterior route underneath the bladder, likewise, is a relatively safe procedure. We attempted both of these routes, using a three inch 19 gauge flexible needle. In only about half the cases could we gain access to the amniotic cavity. The punctures usually caused considerable bleeding, particularly in the anterior route, and in some of the cases the liquor amnii was tinged with blood, making the specimens useless. Some of the cases in which we successfully obtained liquor amnii continued to leak fluid or were followed by rupture of the bag of waters. Furthermore, repeated punctures on the same patient were impossible because of the complications cited, plus the discomfort and the increased danger to the patient. We, therefore, decided that the vaginal route was not feasible for our problem.

Puncture of the uterine cavity from above was then considered. It had been done only rarely and was considered to be dangerous to the patient. The uterus closely approximates the abdominal wall during the last six or eight weeks of pregnancy and during the entire last trimester, when the uterus is abnormally large because of a polyhydramnion. Unless the patient has adhesions, due to a previous operation, there is little danger of injury to the intestines, when the patient is in the supine position. When the bladder is empty, it is usually a pelvic organ and, therefore, out of danger. Leakage of fluid into the abdomen was not noticed and evidently does not occur. Theoretically, there is a possibility of sticking the child, but this does not often happen and a needle prick would do damage in very few places on the child's body.

The first attempts were made on patients during cesarean section. On opening the peritoneal cavity, the lower uterine segment, or any other site on the uterus beneath which there appeared to be fluid, was punctured with a three inch 19 gauge needle and a sample of fluid withdrawn. The syringe was then disconnected and one cubic centimeter of Congo red injected. At varying time intervals a second sample of fluid was withdrawn through the same locality. The baby was moved about in the uterus to secure an even distribution of the dye in the liquor amnii. We observed that there was absolutely no leakage of fluid through the needle punctures in the uterus. Furthermore, since it was a simple procedure, with apparently little risk to the patient, we concluded that abdominal puncture of the uterine cavity was entirely feasible in carefully selected cases. This procedure is further justified because it opens up an entirely new field of investigative possibilities on the physiology and pathology of pregnancy, labor, and membrane permeability.

The patients we selected for this procedure were in the hospital for the various complications of pregnancy. Many of them had toxemia. All of them were in their last trimester, the majority at or near term. In most of the cases we obtained three samples of fluid, which necessitated three punctures of the uterine cavity. The first sample was taken before the injection of the dye and two samples after its injection. The time interval between samples was noted. In several cases, puncture of the usual site yielded pure blood, and the needle was withdrawn. If blood was obtained on the opposite side of the uterus, it was concluded that the needle had entered the placenta, because of its unusually low attachment. Needle puncture of the placenta in situ would probably yield pure blood because of its extreme vascularity without causing any damage to its substance or attachment. In two instances this happened at operation and the low-lying placenta was found. The placenta and its site were carefully examined, but we failed to find a hematoma or other sign of damage. In three or four other instances, the patients subsequently delivered from below entirely uneventfully, and the placentae were entirely negative. No puncture marks on the baby could be seen in any case.

Our first patient was one near term with a moderate polyhydramnion and a floating head. After carefully preparing the skin with iodine and alcohol, the skin was anesthetized with one-half per cent novocaine. Some novocaine was injected into the abdominal wall, along the line of the proposed puncture. The amniotic cavity was entered easily, a sample of fluid obtained, and the dye injected. Several more samples were easily obtained at varying time intervals, to determine the time necessary for complete diffusion of the dye.

#### TECHNIC

The uterine cavity can be best entered 5 to 6 cm. above the symphysis, when the patient is on her back and the bladder completely emptied. The right or left of the mid-line is chosen, depending on which side fluid is more easily palpable. Usually, it is

easiest to gain access to the uterine cavity on the side opposite the back. The patient may suddenly jerk when the needle goes through the peritoneum. About 5 c.c. of clear liquor amnii are withdrawn, the syringe removed, and by means of a tuberculin syringe 1 c.c. of Congo red injected. The needle is withdrawn and a second puncture is made in an hour, at which time a second 5 c.c. sample of pinkish liquor amnii is aspirated.

A 1.5 per cent solution of Congo red in water is placed in 2 c.c. ampoules, sealed and autoclaved. The standard consists of a 1:400 dilution of the dye. The colorimeter is set at 20, and the standard is diluted so that the color approximates that of the unknown. The dilution is always in multiples of 400, that is, 1:800; 1:1200; 1:4000, etc. The calculations are as follows:

$$\frac{20}{X} = R. \frac{\text{cubic centimeters of dilution}}{R} = \text{cubic centimeters of amniotic fluid}$$

One of the problems connected with the dye method was the determination of the most satisfactory time after injection for the removal of the liquor amnii to determine the volume. One must allow adequate time for a thorough mixing of the dye with the fluid. There is no current in the amniotic cavity, but the movements of the fetus aid diffusion. Samples of fluid were removed at various intervals and it was found that a thorough mix could be secured in from fifteen to sixty minutes, depending on the volume of fluid (see Table II). In the circulation Smith has shown that about 12 per cent of the dye is removed the first hour. However, in the amniotic cavity, the dye disappears very slowly and there is no appreciable loss in 24 hours. In two patients we removed samples at the end of 12 and 24 hours and the readings were alike within the limit of error. The dye will completely disappear from the liquor amnii in about a week or 10 days. The membranes and placenta were examined in two cases, after several injections of dye into the uterus, and no evidence of the Congo red could be seen grossly or microscopically in the cells. The dye must be removed by the maternal circulation.

#### DISCUSSION

The colorimetric dye method used in blood volume work is applicable for the quantitative determination of the liquor amnii in utero. Roth, in vivo and vitro experiments with this method, has shown that determinations

TABLE I. COMPARISON OF VOLUME CALCULATED BY DYE METHOD AND ACTUALLY MEASURED AT DELIVERY

CASE NO.	VOLUME DYE METHOD	VOLUME OF FLUID COLLECTED AT DELIVERY
52069	413 c.c.	400 c.c.
56663	1110 c.c.	1050 c.c.
57857	976 c.c.	950 c.c.
60943	460 c.c.	450 c.c.
54309	490 c.c.	450 c.c.
55784	317 c.c.	300 c.c.

TABLE II. COMPLETE DIFFUSION OF DYE WITHIN AN HOUR  
CASE 57855. POLYHYDRAMNION

	Dye injected	
11:40 A.M.	First sample	1730 c.c.
12:40 P.M.	Second sample	1758 c.c.
1:00 P.M.	Third sample	1712 c.c.
1:20 P.M.	Fourth sample	1738 c.c.
1:40 P.M.	Fifth sample	1730 c.c.
2:00 P.M.		

can be carried out with a maximum error of 5 per cent. In the patients in whom we were able to collect the liquor amnii at delivery, our results were well within this limit of error (see Table I). The procedure as described in carefully selected cases carries with it little danger, as no untoward results occurred in 25 cases, which serve as a basis for this preliminary report. It is, however, not without conceivable danger.

The average amount of fluid in the majority of cases was distinctly less than that given by Lehn. The number of observations are too few to draw any conclusions at the present time. The amount of liquor amnii is not constant nor does it always increase with the duration of pregnancy. In one patient in which we were able to obtain five readings at varying inter-

TABLE III. DECREASE IN LIQUOR AMNII WHILE PATIENT WAS UNDER OBSERVATION  
CASE 56424. POLYHYDRAMNION

3-24-32	1610 c.c.	
3-25-32	1655 c.c.	
4- 8-32	932 c.c.	
5- 2-32	417 c.c.	
5- 5-32	490 c.c.	
5- 5-32	350 c.c.	Actually collected
	Delivery	

vals, during the last six weeks of pregnancy, the amount of fluid consistently diminished (see Table III). At the time we ruptured the membranes at term, there was present only one-fourth the fluid calculated at the first observation. Clinically, she presented a moderate polyhydramnion when first seen, which gradually disappeared. The amount of fluid may be entirely dependent on maternal metabolic processes, which when altered give rise to pathologic quantities.

The rate of absorption of various colored solutions from the amniotic cavity of the rat and their transmission through the placenta has been recently studied by Boucek and Renton. We shall make similar studies on the human being because of the feasibility of injecting colored solutions into the amniotic cavity without disturbing the pregnancy. The Congo red used in our experiments entirely disappears from the amniotic fluid and finds its way into the maternal circulation, although the rate of absorption for this dye is slow. Many physiologic problems on the interrelationship between the maternal and fetal organisms have been suggested by this additional method of study.

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## HYPERTHYROIDISM ASSOCIATED WITH PREGNANCY\*

FREDERICK A. BOTHE, M.D., PHILADELPHIA, PA.

THE increased secretion of the thyroid gland is the most readily observed of the physiologic changes which occur in the activity of the endocrine glands during pregnancy. Our present knowledge does not permit us, in many instances, to differentiate clearly between this physiologic hyperactivity and hyperthyroidism. In this paper I wish to discuss the influence of hyperthyroidism on pregnancy, and the diagnosis and treatment of hyperthyroidism associated with pregnancy.

Apparently the state of pregnancy demands an increased secretion of the thyroid gland. Observations by Fleischer,<sup>1</sup> Seitz,<sup>2</sup> and others, and experimental studies by Anselmino and Hoffman,<sup>3, 4</sup> and Davies, Meakins, and Sands,<sup>5</sup> have supported this belief.

Hyperthyroidism whether it is due to a toxic adenoma or exophthalmic goiter, results in relative sterility. Estimations of the percentage of normal fertility have been given in studies by Gardiner-Hill,<sup>6</sup> Mussey, Plummer, and Boothby,<sup>7</sup> and Mussey and Plummer.<sup>8</sup> Hyperthyroidism not only decreases normal fertility but is a serious complication for a successful termination of pregnancy. This was noted in studies made by Gardiner-Hill,<sup>6</sup> and Seitz.<sup>2</sup>

A follow-up study was made of the female patients between the ages of nineteen and thirty-five, who were operated upon at the Presbyterian Hospital on the services of Doctors Jopson, Hodge, and Speese, between Jan. 1, 1926, and Jan. 1, 1931, to determine the effect of thyroidectomy upon fertility and subsequent pregnancies. There were 48 patients in all. Eleven were not married at the time of operation. Of the remaining 37, 26 or 70 per cent gave a history of one or more miscarriages before thyroidectomy was performed. Only twenty patients could be traced. Of these 20, 10 have had successful pregnancies and one has had two successful pregnancies. There has been one miscarriage. Two patients operated upon during pregnancy have each had one successful pregnancy since operation.

Patients suffering from hyperthyroidism complicating pregnancy are divided into two groups: (1) those of mild toxicity, and, (2) those of severe toxicity. In both groups toxic adenomas and exophthalmic or hyperplastic toxic goiters occur. In cases of mild toxicity the most constant symptoms are increasing nervousness, tachycardia, tremor, slight exophthalmos, definite emotional instability and fatigue. The basal metabolic rate is elevated to plus 30 to plus 35. These figures are only approximate as the rate varies. In cases of severe toxicity these symptoms are

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more pronounced, the symptoms and findings in the peripheral circulation are more advanced, and the derangement of the sympathetic nervous system as manifested by nausea, vomiting, and diarrhea is evident. In both groups toxic adenomas are usually seen later in life. This is of significance in our judgment as to treatment.

Certain atypical patients have clinical manifestations which warrant a study of the degree of activity of the thyroid gland during pregnancy. This study should be made in patients having cardiovascular symptoms, particularly tachycardia, which are out of proportion to the pathologic findings elicited by an examination of the cardiovascular system, as we know that this increased activity of the thyroid gland is not infrequently the cause of such symptoms in the nonpregnant woman. Two patients came under my observation with unexplained tachycardia during the early months of pregnancy, who subsequently were found to be suffering from moderately severe hyperthyroidism. Such a study may also be of assistance in the treatment of cases of toxemia of pregnancy which do not respond to the usual therapeutic measures. Falls<sup>9</sup> reported three patients who were referred to the hospital with the diagnosis of hyperemesis gravidarum who proved later to have exophthalmic goiters, with an acute crisis. Davis and Harper<sup>10</sup> reported a similar case. Falls<sup>9</sup> had four additional cases that had concomitant symptoms of eclamptogenic toxemia. Of the patients seen at the Presbyterian Hospital with hyperthyroidism either in the pregnant or nonpregnant state, a high percentage gave a history of prolonged nausea and vomiting during their previous pregnancies. Though only eleven cases have been observed, they have all noted a great decrease in the morning nausea and vomiting in pregnancies subsequent to thyroidectomy. Stander and Peckham<sup>11</sup> in a careful study, found the basal metabolism was higher in the toxemias of pregnancy.

An illustrative case was Mrs. H. M., thirty-two years of age, admitted to the Presbyterian Hospital with a diagnosis of hyperthyroidism associated with pregnancy. She had suffered from nausea and vomiting for four months. Many days she vomited all food taken by mouth and at times spent seven to ten days in bed. A history and physical examination revealed that she was in the sixth month of pregnancy complicated by a severely toxic adenoma. After rest in bed and Lugol's Solution, a subtotal thyroidectomy was performed. The patient made an uneventful convalescence and was symptomatically improved. At follow-up clinic six weeks after discharge from the hospital, the pulse was eighty, the symptoms had disappeared and the emotional stability was satisfactory. The basal metabolic rate was plus twenty-four which is within normal limits at the beginning of the eighth month of pregnancy. She was admitted to the hospital just before term because of hypertension; the blood pressure ranging from 160/80 to 170/90. No symptoms of toxemia developed and she was delivered of a normal child at term. She was again pregnant in December, 1931, which was subsequent to thyroidectomy. In this pregnancy nausea was present for two weeks in the second month, but no vomiting occurred. In the seventh month a careful examination revealed no evidence of recurrence of hyperthyroidism. At the first reading the blood pressure was found to be 166/88, but after the patient was allowed to calm down for a few moments, it fell to 130/80. The pregnancy terminated successfully at term with no complications.

In the last decade the use of iodine as a therapeutic measure in toxic goiter has been placed on a firmer basis and thyroidectomy has been performed more frequently during pregnancy. Series of patients in whom thyroidectomy has been performed during pregnancy, have been reported by Mussey and Plummer,<sup>8</sup> Lahey,<sup>12</sup> Fabrini,<sup>13</sup> and Falls.<sup>9</sup> The results in these series were most favorable and demonstrated that thyroidectomy performed during pregnancy is not as hazardous a procedure as it was once thought to be.

At the Presbyterian Hospital, ten patients have been seen with hyperthyroidism complicating pregnancy. Eight were in the group of severely toxic goiters and two in the group of mild toxicity. The two mild cases were treated medically with a successful termination of pregnancy. Of the eight cases of severe toxicity, two refused operation, one miscarried in the hospital before surgery could be performed, and in the remaining five, a subtotal thyroidectomy was performed, three being operated upon in the first four months of pregnancy and two in the sixth month. In the five cases operated upon, the pregnancies were successful at term.

It is not infrequently stated in the literature that permanent relief is obtained in many cases of hyperthyroidism after the termination of a successful pregnancy. Gardiner-Hill<sup>6</sup> stated that in 50 per cent of his series, improvement was maintained thereafter. At the Presbyterian Hospital we have seen five patients all of whom had had a normal delivery at term in whom the symptoms of hyperthyroidism persisted postpartum. Due time was allowed for the readjustment of the glandular function. In four cases operation was advised during the second and third months after delivery. Two refused operation and have not been traced. Two patients were operated upon, and their convalescence was uneventful and there has been no recurrence of the disease.

The fifth case was a woman, twenty years of age, admitted to the Presbyterian Hospital March 17, 1932, with a diagnosis of exophthalmic goiter in an acute crisis. In the past history she had had two normal children, one in August, 1930, and the second on December 27, 1931. During the last six weeks of the second pregnancy, moderately severe hyperthyroidism developed. The delivery and puerperium were normal in every way, except for the presence of symptoms of hyperthyroidism. These symptoms progressed after delivery, medical measures were instituted, and in two weeks, which was five weeks postpartum, the symptoms had subsided, the pulse was 80 and the basal metabolism was zero. She was then discharged with instructions to return to the dispensary for close observation. The patient did not return, however, for six weeks, and at that time she was in a severe thyroid crisis. She was admitted to the hospital and treated by rest in bed, sedatives, and Lugol's Solution, in large doses. The response to these measures was not sufficient to warrant a partial resection of the gland, so five weeks after admission a ligation of the right superior pole was performed. She reacted poorly to this procedure and a bilateral ligation could not be attempted. In six weeks when improvement was apparently at its height, a right lobectomy was done. The patient immediately went into a severe postoperative crisis, did not respond to the routine therapeutic measures for this complication, and died on the third postoperative day. A summary of the autopsy report stated that the thymus was present and weighed 22 gm., and there was a tendency to general lymphoid hyperplasia

throughout the various lymph nodes of the body. A marked hypoplasia of the cardiovascular system was present. These five cases show rather conclusively that we should not be too strong in our belief that the symptoms of hyperthyroidism will be permanently relieved after a normal delivery at term. A complete study of the activity of the thyroid gland should be made at intervals after delivery, in patients who had hyperthyroidism complicating a pregnancy.

It has been shown that patients who have clinical evidence of a physiologic hyperactivity do better on small doses of iodine during pregnancy. This therapeutic measure in conjunction with increased rest is usually all that is necessary. In mildly toxic cases medical treatment is instituted first. The patients are placed at rest in bed, given sedatives, Lugol's Solution, ten drops, three times a day, and isolated from any external stimulus that may upset their emotional stability. If improvement or complete relief of symptoms is maintained, medical care is continued during pregnancy. Careful study of these cases is essential in the first three or four months, because if there is a recurrence of symptoms, though medical measures were carried out, a subtotal thyroidectomy is indicated. In mild border-line cases which occur early in pregnancy, surgery is recommended more frequently in toxic adenomas than exophthalmic goiters. Toxic adenomas occur later in life as a rule and the heart muscle is not as likely to be able to withstand the myocardial changes and the strain of a delivery, as it is earlier in life. If a mild case is seen late in pregnancy, the thyrotoxicosis can usually be controlled by medical measures. The activity of the thyroid gland should be studied after delivery and these studies will determine the proper treatment.

In severely toxic cases, our treatment should be directed at the thyroid. A subtotal thyroidectomy is indicated after preoperative preparation of the patient. This is particularly true if the patient is seen in the first five months of pregnancy. In extreme cases this procedure may not be possible, and a unilateral or bilateral polar ligation should be done depending upon the patient's condition. We now know that a general anesthesia and major surgical procedure which is not directed at the thyroid, performed upon a patient suffering from hyperthyroidism, results fatally in many instances. Cases have been reported in which tonsillectomy and extraction of the teeth have resulted fatally in patients suffering from hyperthyroidism. Lahey<sup>9</sup> advises deferring any major surgical procedure until six months after thyroidectomy. For these reasons many feel that therapeutic abortion should not be performed in this group of patients.

It is suggested that patients having symptoms or clinical findings which point to an increased activity of the thyroid complicating pregnancy, whether it be of the physiologic or pathologic type, should be studied by both the obstetrician and the surgeon. The patient should be seen by both of them at intervals during pregnancy and after delivery. By this type of management both the obstetrician and surgeon would see a greater number of this group of patients, and a more thorough understanding would develop which would assist us in solving the diverging viewpoints which



now exist as to the proper therapeutic measures which should be instituted. By follow-up studies we could then determine more accurately the remote results from the adoption of such measures. Great progress has been made by such a combined management when diabetes complicates pregnancy, and a similar result should occur by such cooperation.

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## ABSTRACT OF DISCUSSION

DR. COLLIN FOULKROD.—The view is gaining that thyroid conditions must be handled together by the thyroid clinician and the obstetrician. This will lead to better results.

It seems to me that the study of young women before marriage and pregnancy should include a study of the thyroid. It is a well known fact that in pregnancy readings are a little more difficult to secure, and a more accurate reading can be taken when there is no pregnancy. I have sent pregnant patients to three different clinics, and had three different readings; and the answer was that the patient was not quiet enough to give a good reading.

We feel that the study of the thyroid activity of young girls is a very grave necessity in preparing for pregnancy.

There were other patients in whom enough thyroid extract would encourage them to be less nauseated and go on to term normally.

DR. CHARLES MAZER.—It seems paradoxical that both extremes of thyroid function are productive of the same symptoms in relation to menstruation and pregnancy, that is, delayed and prolonged bleeding or abortion.

Amenorrhea, dysfunctional uterine bleeding and the tendency to repeated miscarriages, associated with a low basal metabolism, are frequently relieved by the administration of thyroid tissue.

Hypertthyroidism, as seen in exophthalmic goiter, on the other hand, often produces the same menstrual and gestational symptoms. Simple hypertthyroidism, however, is usually free from menstrual disorders and the tendency to abort. It therefore seems that the excessive production of thyroxin is not the responsible agent and that exophthalmic goiter is a severe constitutional disease with goiter symptoms and not simply a form of hypertthyroidism.

Experimentally, Weichert has shown that injections of thyroxin into adult rats suppress estrus through excessive stimulation of the anterior pituitary lobe which, in turn, produces hyperluteinization and a state of pseudopregnancy. Clinically, however, the amenorrhea of women suffering from exophthalmic goiter cannot be explained on the basis of a persistent corpus luteum and a state of pseudopregnancy.

## CONCERNING DEATH OF THE FETUS IN PREGNANCY\*

J. STUART LAWRENCE, M.D., PHILADELPHIA, PA.

(*From the Obstetric Department, St. Mary's Hospital*)

THIS paper has two purposes. The first is to report the evidence supporting a theory that starvation of the fetus in utero, due to imperfect osmosis through a definite type of abnormal placenta, is, in some cases, the cause of fetal death; together with a description of the therapy devised to overcome this defect. The second purpose is to present a method for the early diagnosis of fetal distress from any cause in pregnancy.

### I. INTRAUTERINE STARVATION DUE TO IMPAIRED PLACENTAL OSMOSIS OF NUTRIMENT IS ONE OF THE CAUSES OF FETAL DEATH IN PREGNANCY, AND THE THERAPY BASED ON THIS CONCEPTION

Some of the causes of fetal death in pregnancy are known. Syphilis, maternal nephritis, and lead poisoning are established causes. Severe influenza, scarlet fever, and cardiac lesions of the mother are suspected. But, in any large series of pregnancies observed and accounted for, from the fourth month on, there will usually be found instances of a few fetal deaths before the onset of labor where neither syphilis, nephritis, lead, influenza, or cardiac lesion have played a part and whose causes are unknown. It is with the cause of some of these unknown deaths that we are concerned. In presenting the evidence, the question arose whether all of it should be used or simply a brief statistical tabulation presented. The former course has been chosen, despite added length and diversion of attention, because not only is the evidence cumulative, but the history of the initial case of the series is significant both as an unusual vital experiment and as a starting point for the working hypothesis.

This investigation was commenced in 1919 when the following clinical problem presented itself for solution. A woman thirty-four years of age stated that of five previous pregnancies, the infants of the two last had died, one in utero toward the end of pregnancy, one just after birth; and, that being again pregnant for the sixth time desired, if it were possible, to know the cause. The obstetric history was as follows:

The patient, in 1919 a para vi, had promptly conceived, easily carried and quite easily delivered spontaneously, the first two infants who were sound specimens, alive in 1931; and had progressed through a normal puerperium in each. In the labor of the third infant, however, an unknown complication had occurred which had resulted apparently in a puerperal infection of some severity. Two pregnancies had followed the puerperal infection. In the first of these two, the infant had died toward the end of pregnancy; in the second the infant had died just after birth. The first of these stillbirths was apparently well developed. The second was undernourished, wizened, and weighed less than six pounds. At the time of consultation (1919), the patient was

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in about the third month of the current or sixth pregnancy. A thorough study of a detailed history and a painstaking general, chemical and serologic examination established that the patient was then a healthy woman, and did not reveal the presence of any of the common causes of fetal death in utero, either in pregnancy, i. e., syphilis, nephritis, lead; or in labor, i. e., contracted pelvis, etc. The only abnormalities found were an erosion surrounding a deep bilateral laceration of the cervix, producing leucorrhea, and internal hemorrhoids, one of which was a fibrous ball. There was, in 1919, no other discoverable lesion. Therefore, in the absence of any demonstrable or half-demonstrable cause for these deaths, a hypothesis of intrauterine starvation was erected to serve as a working diagnosis, based on the following pure assumptions, the validity of which the course of this case and the additional evidence, clinical and therapeutic, will have to support. It was assumed (a) that an endometritis developed after the third pregnancy because there was known to be an erosion and a leucorrhea, and because of the infection that had occurred in the third puerperium; (b) that a chronic placentitis had existed in each of the fourth and of the fifth pregnancies due to the endometritis; (c) that such a placenta would be so poor an osmotic membrane, so poor a filter, that even carbohydrates<sup>1</sup> in ordinary amounts would find difficulty in filtering through it. It was imagined that the placentitis might have been somewhat of the syphilitic type, consisting of an increase in and coarsening of the connective tissue in both the maternal and fetal portions of the placenta, and of a decrease in arborization.

A successful therapy based on this hypothesis would depend on finding and supplying nourishment in a form that could most easily osmose through such a thickened placenta. It was believed that an excess of carbohydrates might be capable of filtering through such an obstruction in amounts sufficient to nourish the fetus. It was therefore decided to place the patient on an excessively rich but not exclusive carbohydrate diet. This was before the time that Titus<sup>2</sup> had demonstrated the value and use of glucose intravenously, but the object was obtained then by requiring cereals, sugar, honey, molasses, potatoes, simple puddings, etc., in daily excess of the amounts usually consumed by this patient and in addition one-half pound daily of either hard candy or bonbons. Exercise, to the extent of three to five miles walking a day was required to prevent storage of the unused carbohydrates. These two requirements were the only means prescribed in addition to the usual hygiene of pregnancy. Subject to this diet and degree of exercise, the sixth pregnancy went to full term with a live fetus and labor resulted in a live baby, vigorous and without defect, weighing 8 pounds 14 ounces. In the course of this case, blood sugars were not determined (in later ones they were and in all such cases at the present time, blood sugars are determined at fixed intervals and hours), but regular weekly analyses of twenty-four-hour collections of urine for glucose were made and, strikingly enough, did not once disclose a trace of glucosuria. Nor did the patient become fat. On the contrary, she was physically better at term than at three months. Both of these phenomena could have been due to the vigorous exercise required, but they could also have been due to consumption of the excess carbohydrates by the fetus, leaving little to be stored as maternal fat. There was no edema, constipation or headache, but there was a lack of appetite.

The labor was the usual three-hour labor of this patient, and spontaneous. The placenta was expelled complete as were the membranes, but was delayed fifty minutes. It was washed and flushed. Macroscopically, it was a small placenta of a very few cotyledons each one separated from the other by a clearly visible band of what appeared to be connective tissue. The cotyledons were hard rather than spongy and were not plump. The color was a blue gray. There were but few infarcts either white or red. Microscopically, the diagnosis was chronic placentitis, a term meant to sum up a picture in which there were: first, an excess of connective tissue; second, a decrease in arborization; third, a coarsening of both the maternal and fetal elements; fourth, many areas where the syncytium could not be demonstrated.

It was felt that the value of the working hypothesis of fetal starvation due to impaired placental osmosis had been increased both by the favorable clinical result and by the character of the placenta, and that its status had advanced to the stage of a theory, a conviction that the subsequent course of this case confirmed.

Six months after the sixth labor, the cervix was amputated, the uterus carefully curetted and every effort made to eradicate the endometritis, and so successfully that the leucorrhea ceased. A year and a half later, the patient was delivered of her seventh infant and again it was alive. Careful examination of the placenta of this ovum and comparison with slides of that of the sixth pregnancy, demonstrated an almost normal placenta. At a later date, an eighth infant was born alive, the placenta being normal. It was believed that the clinical results and the comparison of the sixth with the seventh and the eighth placentas, proved the original hypothesis correct, and it was therefore concluded as a fact in this particular case that:

1. The cause of the successive intrauterine deaths of the fetus was starvation.
2. The coarsened fibrous placenta had prevented osmosis.
3. The carbohydrates could osmose through.

It is true that this was but one case and that we were founding a theory thereon, but owing to the large number of pregnancies undertaken by this woman, it should rather be regarded as a series of eight vital experiments with one common factor or control, an identical mother.

Naturally this case interested us a great deal, and we determined to investigate our material to find out whether the history described above represented a single, perhaps accidental, case of starvation of the fetus or a regularly recurring, if rare, cause of death in any large series. The first step was to determine whether in the past instances of intrauterine fetal death in pregnancy had occurred without demonstrable cause, i. e., syphilis, nephritis, or lead. We found that each year such cases had occurred but not frequently. Since 1922, we have been routinely studying, and observing carefully, the apparent condition in utero of all fetuses; the causes of all deaths in pregnancy; and various methods of determining distress. Considerable evidence has accumulated in proof of our theory, and some evidence that is not favorable. To illustrate the existence and incidence of placentitis as a cause of distress among infants living and dead, the following analysis of 645 pregnancies of a consecutive series studied week by week is submitted, which reports the favorable and unfavorable data.

All of the morbid processes maternal and fetal, associated with each fetal death especially those dying in pregnancy before the onset of the act of delivery (be it premature or fullterm labor) are set down. The placenta of each case in this series, living and dead, was closely inspected macroscopically by a competent observer and microscopically when in his opinion it was indicated. No placenta has been described as being the seat of placentitis without a microscopic study.

Number of pregnancies in this series was	645
Number of infants to be accounted for was	649
Number of stillbirths from the second lunar month of pregnancy until full term was	12
Number of neonatal deaths was	18
Number of infants alive on the tenth day was	619

Considering first the stillbirths (second lunar month to full term), seven of whom manifested distress in pregnancy, we find the following morbid processes associated:

#### STILLBIRTHS MANIFESTING FETAL DISTRESS IN PREGNANCY

- One case 4 to 5 lunar months, placentitis chronic, toxemia mild stage.<sup>4</sup>
- One case 7 lunar months, placentitis acute.
- One case 9 lunar months, compression of cord.
- One case 9 lunar months, placentitis chronic.
- One case 9 lunar months, placentitis chronic, myxomatous degeneration of placenta, abruptio placentae previae.
- One case 10 lunar months, toxemia severe stage, renal type.<sup>4</sup>
- One case 10 lunar months, placentitis, toxemia severe stage, hepatic type.<sup>4</sup>

#### STILLBIRTHS NOT MANIFESTING FETAL DISTRESS IN PREGNANCY

- One case 10 lunar months, strangulation. Distress manifested in labor.
- One case 2 lunar months, infantile uterus.
- One case 8 lunar months, placentitis chronic, epilepsy.
- One case 9 lunar months, abruptio placentae, trauma.
- One case 9 lunar months, occiput posterior, Scanzoni.

Considering the eighteen neonatal deaths, four of whom manifested distress in pregnancy, we found the following associated morbid processes:

#### NEONATAL DEATHS MANIFESTING FETAL DISTRESS IN PREGNANCY

- One case 7 lunar months, placentitis chronic, weight 3 pounds 15 ounces.
- One case 10 lunar months, no kidneys in fetus; lived a few minutes.
- One case 10 lunar months, toxemia mild stage,<sup>4</sup> only association.
- One case 10 lunar months, placentitis, eclampsia, infantile subdural hemorrhage.

#### NEONATAL DEATHS NOT MANIFESTING FETAL DISTRESS IN PREGNANCY

- One case 7 lunar months, endometritis, weight 5½ pounds; distress originated in pregnancy.
- One case 9 lunar months, unknown; distress originated in labor.
- Five cases 10 lunar months, subdural hemorrhage; distress originated in labor.
- Three cases 10 lunar months, infantile congenital defects compatible with intra-uterine, incompatible with extrauterine life; distress originating in the neonatal period, vis dextrocardia, spina bifida, no interventricular cardiac septum.
- One case 10 lunar months, congenital defect, melena; placenta previa, distress originating in pregnancy.
- One case 10 lunar months, one twin; distress originating in neonatal period.
- One case 10 lunar months, unknown; toxemia severe stage; distress originating in labor.
- One case 10 lunar months, enteritis; distress originating in neonatal period.

Considering finally the 619 infants alive on the tenth day after birth, nine of whom manifested distress in pregnancy, the following associations were found:

#### LIVING INFANTS MANIFESTING FETAL DISTRESS IN PREGNANCY

- Three cases, chronic placentitis, the only association.
- One case, acute failure of maternal cardiac compensation.

One case, placentitis and hydorrhea.  
One case, maternal anemia, toxemia mild stage.  
One case, trauma the only associated phenomenon.  
One case, acute maternal bronchitis in pregnancy.  
One case, maternal cardiac, mitral, lesion.

#### LIVING INFANTS NOT MANIFESTING FETAL DISTRESS IN PREGNANCY

Four cases, placentitis, the only association.  
One case, placentitis and diabetes.  
One case, placentitis and congenital defect.

Thus we find that among 7 stillbirths manifesting distress in pregnancy, there were associated 5 cases of placentitis, and that twice placentitis was the only associated lesion. Among 5 stillbirths that did not manifest distress in pregnancy, placentitis is associated but once. Among 4 neonatal deaths where distress was manifested in pregnancy, placentitis was an associated finding twice and once the only finding. Among 14 neonatal deaths where distress was not manifested in pregnancy, no case of placentitis was found at all. Among 9 living infants who manifested distress in pregnancy, placentitis was an associated finding in four cases and in three cases the only finding.

However, among 6 living infants not manifesting distress in pregnancy, placentitis was found 6 times, and in 4 cases was the only finding, being instances that do not support the theory. In view of the very positive relation that seems to exist between the stillbirths, the neonatal deaths, and the 9 living infants manifesting distress (not due to labor or congenital defects) and placentitis, we attribute the incidence of placentitis in the group of 6 living infants not manifesting distress to cases of placentitis of less degree. In this series of 645 pregnancies, there were but 6 instances of maternal syphilis. Maternal and cord Wassermanns were made on all. Syphilis is considered to be present if either there is a plus-three or plus-four Wassermann, or if, in the absence of a positive Wassermann, there is clinical evidence of syphilis. Among the 6 cases of syphilis in this series it happened that there were no stillbirths, no neonatal deaths, and no instances of fetal distress in pregnancy. It will be noted that there are several instances of renal disturbances. The examination of the blood disclosed no evidence of lead poisoning in any case.

#### THERAPY

The reason for the excess carbohydrate therapy of those cases of fetal distress in pregnancy that are due to impaired placental osmosis resulting in starvation, has been given. In our opinion, it is valid regardless of whether carbohydrates are the sole food substance filtered through the placenta as Slemons<sup>1</sup> has indicated or whether fats and proteins also filter through. In applying the therapy, two things must be kept in mind; first, as soon as fetal distress due to this cause has been diagnosed, carbohydrates must be very quickly supplied in excess, in a form and by a method that in-

asures the most rapid osmosis possible through the placenta in the largest possible amounts, to enable the fetus to assimilate it at the earliest possible moment. It must be continued in this way until the signs of fetal distress (q. v.) have ceased. Second, after temporary relief has been secured excess carbohydrates must be supplied orally until the pregnancy is over, for while the threat to the fetus will continue until delivery, the maternal metabolism could not stand the temporary measure long. In regard to the method of temporary relief; it was not until Titus<sup>2</sup> had by his researches discovered the potency of glucose, and perfected methods to take advantage of it in the treatment of the toxemia of pregnancy, that we arrived at the best way of supplying temporarily the urgent primary relief required in fetal distress. This lack of knowledge of method and of physiology explains the incidence of stillbirths due to starvation in the series of cases chosen for analysis by us, and is also one of the reasons for choosing this series. It is desired to make it clear that while the method of using glucose that we have devised for the temporary relief of fetal distress due to starvation differs from the method devised by Titus for the toxemia of pregnancy, our method for this totally different purpose owes its existence to the work and research of Titus.<sup>2</sup> For the temporary relief of fetal distress, we administer intravenously from 50 to 150 grams of glucose in from 100 to 200 c.c. of salt solution in a period of about five minutes; usually the smaller amount; and repeat it every four to six hours until the fetal heart becomes normal, usually a period of less than twenty-four hours, when the infant is in distress due to starvation.

It is seldom that glucosuria develops or that blood sugar values above two hundred develop. One such case developed this year (1931) after 125 gm. of glucose, the period of glucosuria being four hours, the period of blood sugar above two hundred being twelve hours. On the other hand, if glucosuria develops after the rapid injection of 50 gm. of glucose, we consider that the distress is probably not due to starvation.

## II. THE EARLY DIAGNOSIS OF FETAL DISTRESS FROM ANY CAUSE IN PREGNANCY

It was important to devise a routine method that would elicit evidence of fetal distress from any cause in pregnancy long enough before death to make therapy possible. At first we could think of but one method, the frequent and reliable count of the fetal heart sounds as often as possible by one observer. To this end the counting of the fetal heart sounds in pregnancy became the duty of the chief and the chief of clinic instead of junior assistants. The following facts were noted as indicative of fetal distress and as trustworthy.

1. That the fluctuation of the fetal heart rate between 120 and 160, which Tweedy had observed to be within the normal limits in labor, an observation we confirm, was not the normal fluctuation in pregnancy; in that rates above 150 are abnormal in pregnancy. That rates in pregnancy above 150 or below 120 indicate distress, when the count is made by a competent person for at least a half minute and confirmed by several repeat counts.

2. That the volume of the sounds of the fetal heart, loud, low, has no significance.
3. That the rhythm is significant in that if reduplication, dropping of beats, or other irregularities of rhythm occurred, it indicated distress.
4. That the demonstration of a funic souffle, not the placental souffle, indicated imminent death, but that it can rarely be heard.
5. That there are certain subjective symptoms that are especially significant of fetal distress, sufficiently significant to cause particular study to be made of all women complaining of them; and to cause conviction of fetal distress when calm, stable types of women reported their presence. These data were obtained by repeated questioning and check of answers with fetal heart rate counts and by final infantile results, over a period of several years up to the present time. The symptoms are as follows:
  - a. There are one or more periods every day when the fetus is felt by the mother to be livelier than usual, and that for each woman these tend to recur day after day at about the same time or under the same circumstances, but not at the same time for all women. Such periods of unusual liveliness are normal.
  - b. A period of unusual liveliness at an hour unusual for a particular woman indicates fetal distress. Such unusual periods of liveliness will precede a cessation of the feeling of "life" in all cases of intrauterine death of the fetus irrespective of cause after the fifth lunar month. In cases of starvation or other causes of slow fetal death, unusual liveliness of the fetus at an unusual time will generally precede the cessation of the sensation of life by several days.
  - c. A period of intensified liveliness at a usual or unusual time, often described by the mother as a "storm" of movement, immediately precedes the cessation of the feeling of life.

#### METHOD ADOPTED FOR THE EARLY RECOGNITION OF FETAL DISTRESS

1. Instruct the mother to determine the time when her infant regularly becomes more than usually lively.
2. If a period of activity occurs at an unusual hour, have the mother report within twenty-four hours.
3. If a period of liveliness, usual or unusual, becomes a "storm," have the mother report at once.
4. Regular and frequent counts of the fetal heart rate in pregnancy, noting rate, rhythm, and souffle.

Patients reporting liveliness at an unusual hour and those reporting "storms" are hospitalized at once for observation and for treatment.

Patients whose fetal heart rates are discovered to be abnormal are hospitalized for observation and treatment even if they do not complain of the symptoms. Treatment now consists of the administration of glucose intravenously until either the abnormal phenomenon becomes normal or the fetus dies. If successful, they are then placed on an oral excess carbohydrate diet and a definite amount of walking, until pregnancy is over.

Analysis of the consecutive series of 645 cases used in Part I, all of whom received regular prenatal care, will serve to illustrate the reliability of this method of diagnosing fetal distress in pregnancy. It should be stated that:

- a. Evidence of fetal distress was regularly looked for throughout the pregnancy of each case, using the method described above or parts of it.
- b. The series chosen to illustrate the accuracy of the method consists of a consecutive series from 1923 to 1927, thus comprising a period in which the best method of diagnosing fetal distress was being routinely determined and not a series comprising the later years which show the method working almost without a failure.



c. A retrogressive check of all cases of stillbirth in which we failed to detect fetal distress in pregnancy was made in consultation with the mother to determine whether fetal distress had manifested itself unobserved. We found that several times, owing to my carelessness or to that of the mother, we had failed to detect manifested signs.

d. We are concerned here solely with a method for diagnosing fetal distress in pregnancy from any cause early enough to permit treatment, and not with the diagnosis of fetal distress in labor. Laferty<sup>3</sup> has reported our view as to the latter in his study of the Tweedy Test of Labor.

e. Specifically, this analysis is offered to show:

1. The incidence of ascertained or ascertainable fetal distress in pregnancy.
2. The efficiency of the method of diagnosis by comparing the diagnosed and diagnosable cases of fetal distress in pregnancy with the number which were undiagnosed or undiagnosable.

Considering first the 12 stillbirths (for details see tabulation) the method showed the fetal distress that existed in pregnancy in 7 of the 12. It was found that in 5 of the 12 stillbirths, the method did not show fetal distress before the onset of delivery, be it abortion, premature labor, or fullterm labor, 4 of these being premature, 1 fullterm. Studying these 5, we find that in 2 cases the distress was caused by and started in labor and so are foreign to our problem, while in 3 of them the distress started in pregnancy before the act of delivery and therefore must be accounted for. One of these was an abortion due to an infantile uterus, which explains the failure of the method; one was due to a trauma that was associated with an abruptio placentae causing almost immediate cessation of the sensation of life, which also explains the failure of the method; and finally, one was a case in which undoubtedly fetal distress in pregnancy had actually existed long enough before death for the method to make it manifest; that it did not is a positive failure which retrogressive check did not explain. Therefore, excluding the stillbirths due to labor and those in pregnancy which the method could not be expected to show, it will be found that the method showed the distress that existed in pregnancy in 7 of the 8 possible cases of fetal distress among the stillborn.

Considering secondly the 18 neonatal deaths; in 4 of the neonatal deaths, the method showed the distress that originated in pregnancy, one being premature, 3 full term. In 14 of the neonatal deaths, the method did not show fetal distress in pregnancy before the act of birth. Reference to the tabulation in Part I shows that in 7 of these, the distress originated in labor; that in 5, it originated in the neonatal period; that in 2 cases, the distress could have and probably did originate in pregnancy, one of which had associated an endometritis but no placentitis. Excluding those cases in which distress originated in labor and in the neonatal period, 12 in number, we find that the method showed the distress among the neonatal deaths that actually did or possibly could have originated in pregnancy in 4 out of 6 cases.

Considering now the babies alive at the end of ten days, it is to be remarked that this group does not afford the absolute proof that distress existed which is obvious in the group of stillbirths and neonatal deaths; in

the absence of death absolute proof of distress fails. But if in a group of living babies the method of diagnosis showed fetal distress in pregnancy and if there were associated with the manifestation morbid processes, maternal or fetal, that would indicate the possibility of distress occurring, then the reliability of the warning that the method gave is increased. In this group there were 15 cases of very probable fetal distress in pregnancy (not in labor) of whom the distress was shown nine times by the method long enough ahead to permit of the institution of successful therapy, while in six cases the probable distress was not shown by the method. Reference to the tabulation of these cases in Part I will show that: there existed among the 9 cases manifesting distress an association of morbid processes sufficient to produce the distress; while among the 6 which the method failed to show, despite the association of a placentitis and, in 2, other grave defects, the method failed absolutely unless, as we believe, the associations were not sufficiently extensive or severe to produce distress. Therefore, without making any deductions or allowances, it may be said that the method indicated distress in pregnancy correctly in 9 of 15 possible cases of distress among the born alive, or in 9 of 10 almost certain cases of distress.

To sum up: the method showed existing fetal distress in pregnancy in (a) 7 of 8 cases of fetal distress in pregnancy among the stillbirths, (b) 4 of 6 cases of fetal distress in pregnancy among the neonatal deaths, (c) 9 of 15 possible cases of fetal distress among the living infants, or 9 of 10 almost certain cases among living infants.

#### CONCLUSIONS

1. There is a type of intrauterine death of the fetus in pregnancy that is due to fetal starvation alone, not to syphilis, nephritis, lead, anemia, or to cardiac disease.

2. The starvation is due to the increasing difficulty that the increasing amounts of nutriment required to nourish the infant meets in filtering through placentas of a definite type.

3. The placentas of this type are characterized by an increase in connective tissue and a coarsening of the maternal and fetal elements.

4. Carbohydrates can filter through such a placenta if given in sufficient amounts and in proper form.

5. The administration of sufficient quantities of carbohydrates in the most diffusible form will temporarily relieve the distress, while an excess but not exclusive carbohydrate diet will prevent the recurrence of distress.

6. Observation of the rate and rhythm of the fetal heart and attention to the reports of instructed mothers regarding the periodicity and quality of fetal movements will often indicate the advent of fetal distress in time to prevent intrauterine death.

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255 SOUTH SIXTEENTH STREET.

### ABSTRACT OF DISCUSSION

DR. T. L. MONTGOMERY.—Dr. Lawrance presents three propositions: first, that a not uncommon cause of embarrassment of fetal nutrition in utero is fibrosis of the stroma of the placental villi and degeneration of the villous epithelium; second, that embarrassment of the life of the fetus may be recognized by certain rather characteristic symptoms and signs; and third, that the nutrition of the fetus so embarrassed may be improved by the administration of large quantities of glucose intravenously, and by an increase in consumption of carbohydrate foods.

As to the first of these propositions it would appear that "fibrosis" is only one of several conditions which might give rise to interference with fetal nutrition. One might also mention hematoma formation in the placenta, and extensive necrosis and calcification of the placenta, both of which conditions are also of rather obscure etiology.

Upon the basis of my own studies in placental pathology, I would suggest that fibrosis, or a lesion which resembles that condition, is not an uncommon finding. I am not sure that this condition as we see it in the placenta is a pathologic entity, or an indication of chronic inflammation. Upon examination of the immature placenta at the fourth or fifth lunar month of pregnancy, one finds a rather free distribution of connective tissue elements in the stroma of the villi. These gradually disappear as pregnancy reaches full term, and in the mature organ there remains only delicate strands of connective tissue interlacing between the villous capillaries. One also finds normally in the mature placenta atrophy and often a complete absence of a distinct epithelial layer surrounding the villi. It would appear highly probable that many of these lesions which are classified as chronic fibrosis, and I have freely and often used the same term, are in reality stages of arrested development in the placenta. One frequently finds in association with this so-called fibrotic appearance a considerable amount of edema. This edema may also interfere with the free osmosis or transfer of food materials between the maternal and the fetal circulation.

However, these considerations are not after all the important ones in the discussion of Dr. Lawrance's paper. We must accept the fact that there are numerous conditions in the placenta which may interfere with the nutrition and growth of the fetus, whether or not these lesions are of a fibrotic character. We are entirely in sympathy with Dr. Lawrance's views as to the recognition of fetal distress during pregnancy, and wish to commend him upon the painstaking studies which he has made of this condition during eight or ten years devoted to gathering material for this paper.

We find in our own experience that pregnant women are most conscious of fetal movement when they are at rest, when taking a nap in the afternoon, or upon retiring in the evening. If fetal movement is so active as to arrest the attention of the mother when she herself is preoccupied with work, then such a phenomenon must be notably significant. The other points which Dr. Lawrance has mentioned in the recognition of fetal distress are also most acceptable.

Perhaps these observations of Dr. Lawrance's may lead to findings of even greater significance. Intrauterine fetal death of obscure type is frequently met with in patients of the so-called endocrine type. Possibly the low fasting glucose which frequently occurs in thyroid and pituitary insufficiency may be the cause of faulty nutrition of the fetus in these instances.

# AN EXPERIMENTAL STUDY OF THE EFFECTS OF INTRA- VENOUS INJECTIONS OF HYPERTONIC GLUCOSE SOLUTION (50 PER CENT) ON THE CIRCULATION OF THE CAT\*

VINCENT P. MAZZOLA, M.D., AND MARCUS A. TORREY, B.S.,  
BROOKLYN, N. Y.

*(From the Departments of Obstetrics and Gynecology and Physiology, Long Island  
College of Medicine)*

ONE of the greatest problems confronting the surgeon is the treatment of shock. Many theories have been advanced as to its cause. Likewise, different opinions are held concerning its treatment. It is known that in shock there is impairment of the circulation resulting in stasis of blood in the capillaries, transudation of plasma into tissue spaces, deficient oxygenation of tissues and diminution of blood volume.<sup>1, 2</sup> These physical and physicochemical changes will eventually impair the function of the heart, due to the extra strain placed upon it by its endeavor to overcome the deficient circulation. It follows then that any treatment of the shock like state must increase blood volume, aim to diminish circulatory stasis, and at the same time provide measures for cardiac support.

Numerous workers have discussed the injection of various substances, and all agree that blood is the best fluid to produce these results. However, in the absence of blood, or because of delay in obtaining the proper donor, or during high temperatures when blood might cause an undesired reaction, it is necessary to use a substitute as an emergency measure. Sodium chloride, glucose, gum acacia, and various combinations of these substances have been recommended.

It is apparent, from the diversity of opinion, that the perfect substitute for blood has not been found. Perhaps there is no such thing. However, all are agreed that, at times, emergency measures are necessary. It would seem that the addition of large quantities of fluid of any kind is dangerous and inadvisable, for it might very well mean the addition of an insurmountable load on an already impaired circulation and weakened myocardium. This might result in cardiac dilatation with severe heart failure. Acacia, at times, produces some unfavorable results, while weak solutions of glucose require large quantities. The ideal solution should act to restore the circulation by increasing the blood volume in the cardiovascular system without overloading, to improve the nutritive state of the myocardium, and to tide the patient over until the necessary blood transfusion can be given.

\*Read, by invitation, at a meeting of the New York Obstetrical Society, November 8, 1932.

Fearing the use of large quantities of fluids intravenously, we<sup>24</sup> have used small doses of 50 per cent glucose (100 to 150 c.c.) clinically with good results. In an effort to explain these results, we have studied experimentally the effects of this solution on the circulation of the cat. Several phases of the problem have been studied, and in this paper, we wish to report the experimental findings on the response of the circulation of the cat to various amounts and rates of injection of 50 per cent glucose, and the effects, both before and after experimentally induced hemorrhage.

### METHOD

Cats were anesthetized with sodium amytal (0.1 to 0.2 gm.) injected intraperitoneally, a carotid cannula inserted and connected with a mercury manometer. A needle was placed in the femoral vein and connected with a burette carrying the solutions. At times the burette was replaced by an ordinary Luer syringe when rapid injections were desired.

The amounts of glucose used varied from 2 to 25 c.c., and both slow and rapid injections were done. The rapid injections were made with a Luer syringe, delivering a maximum of 8.5 c.c. per minute. In the slow method the burette was used, the cock so set that it delivered approximately 1 c.c. per minute.

Blood, for experimental hemorrhage, was removed from either the femoral artery or vein.

In order that our results might not be confused with volume changes per se, we studied a series of cats in which physiologic salt solution was given, intravenously, in varying quantities and rates. Under the conditions of our experiments, the volume of fluid employed could be disregarded, since the changes in heart rate, pulse pressure, and blood pressure were almost insignificant.

### EXPERIMENTAL DATA

The results of the experiments will be described separately. Two groups are presented; one in which the blood pressure was unaltered; i. e., remained at approximately the normal level before the injections were made, the other in which an artificial reduction of blood pressure was produced by hemorrhage.

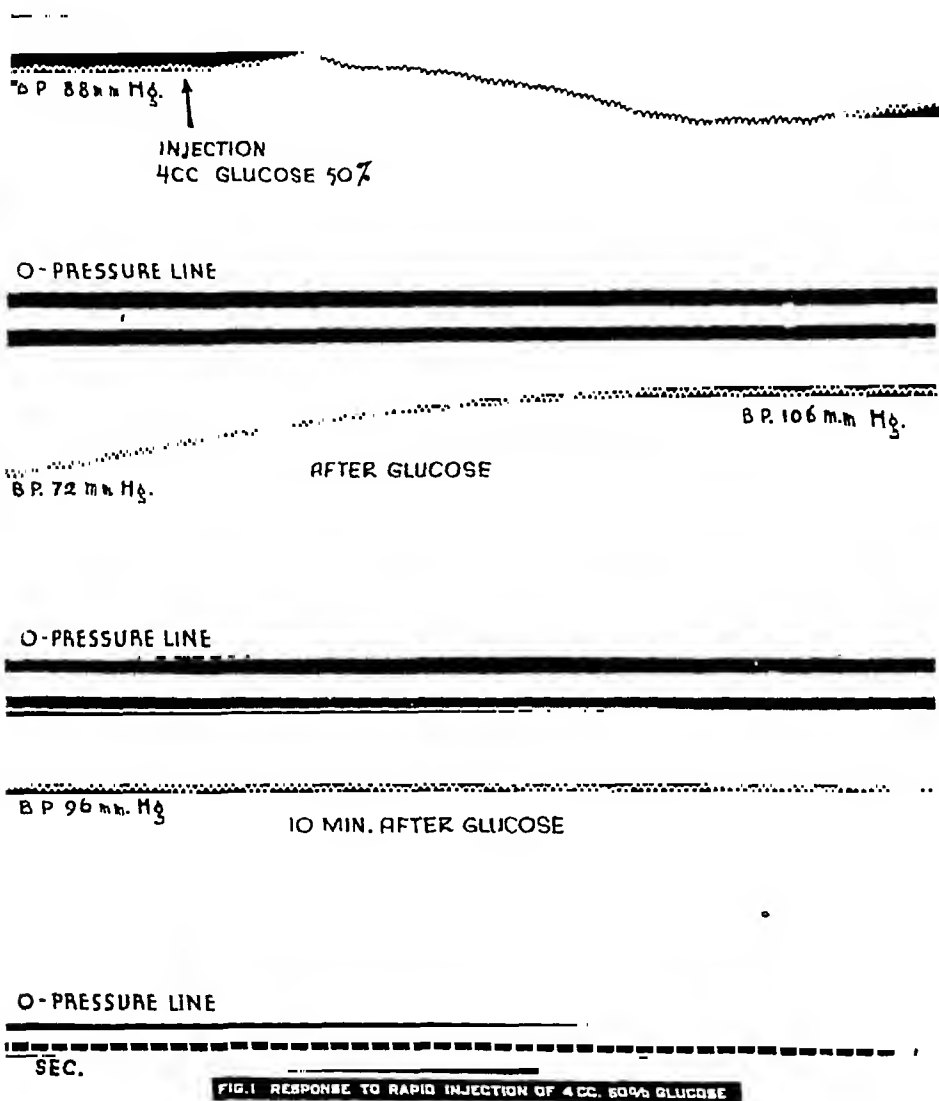
#### GROUP I. UNINJURED CATS WITH NORMAL BLOOD PRESSURE

##### *Rapid Method.*—(10 cats).

1. *Blood Pressure:* In this group the blood pressure changes, following the intravenous injection of 50 per cent glucose, showed four characteristic phases; namely, a (primary) rise, a (secondary) fall, a second rise (tertiary), and a second fall to a maintained level.

The primary rise was small, as a rule, and very transient. We found an average rise of 5.66 mm. Hg. The greatest observed rise was 21 mm. Hg, and the smallest 1 mm. Hg. There was no apparent relation between the amount of glucose given and the magnitude of the rise. The 4 c.c. injection showed a primary rise of 4 mm. Hg while the 12 c.c. injection showed a primary rise of only 1 mm. Hg. The duration of the rise was very short, lasting three to five seconds as a rule.

The (secondary) fall followed immediately after the primary rise, was of longer duration, and more marked. An average fall of 30.56 mm. Hg was found, the greatest being 50 mm. Hg and the smallest 12 mm. Hg. Here there seemed to be some relation between the amount given and the extent of the fall. The larger the quantity the greater the fall, although there was no definite ratio. In Fig. 3 the amount of glucose given was three times as great as the amount given in Fig. 1, but the fall was only 12 mm. Hg greater, i. e. one and one-half times as great. The secondary fall had an



average duration of thirty seconds, reaching the lowest point in from ten to fifteen seconds.

The tertiary rise developed slowly but steadily, and at its high point was usually well above the normal level. The average rise observed from the previous low level was 39.89 mm. Hg, the maximum 81 mm. Hg and the minimum 16 mm. Hg. Again there seemed to be some relation between the quantity given and the magnitude of the rise, but again no common ratio.

Following the high point of the tertiary rise there was usually a slight fall to a level which was maintained for a considerable length of time. Many of these cats were ob-

served for thirty minutes or longer, and during that time the maintained level continued with little or no change. This level was usually above normal. In only one case it was below normal (2 mm. Hg below). In our series it averaged 10.66 mm. Hg above normal with a maximum of 26.66 mm. Hg.

2. *Pulse Pressure:* As a rule, the pulse pressure, as recorded by the manometer, was greater after glucose had been given. In two cats the change was very slight (normal). At the high point it has always been greater than normal. From the original to the

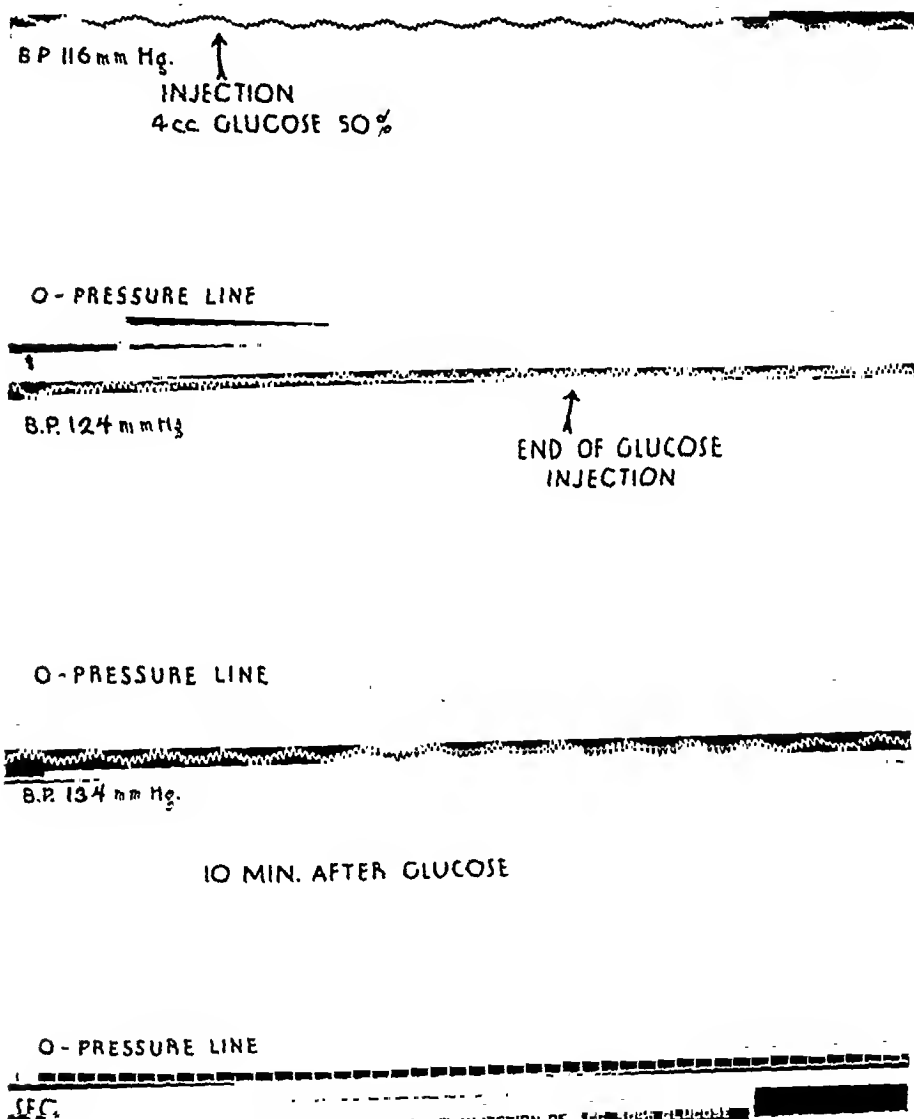


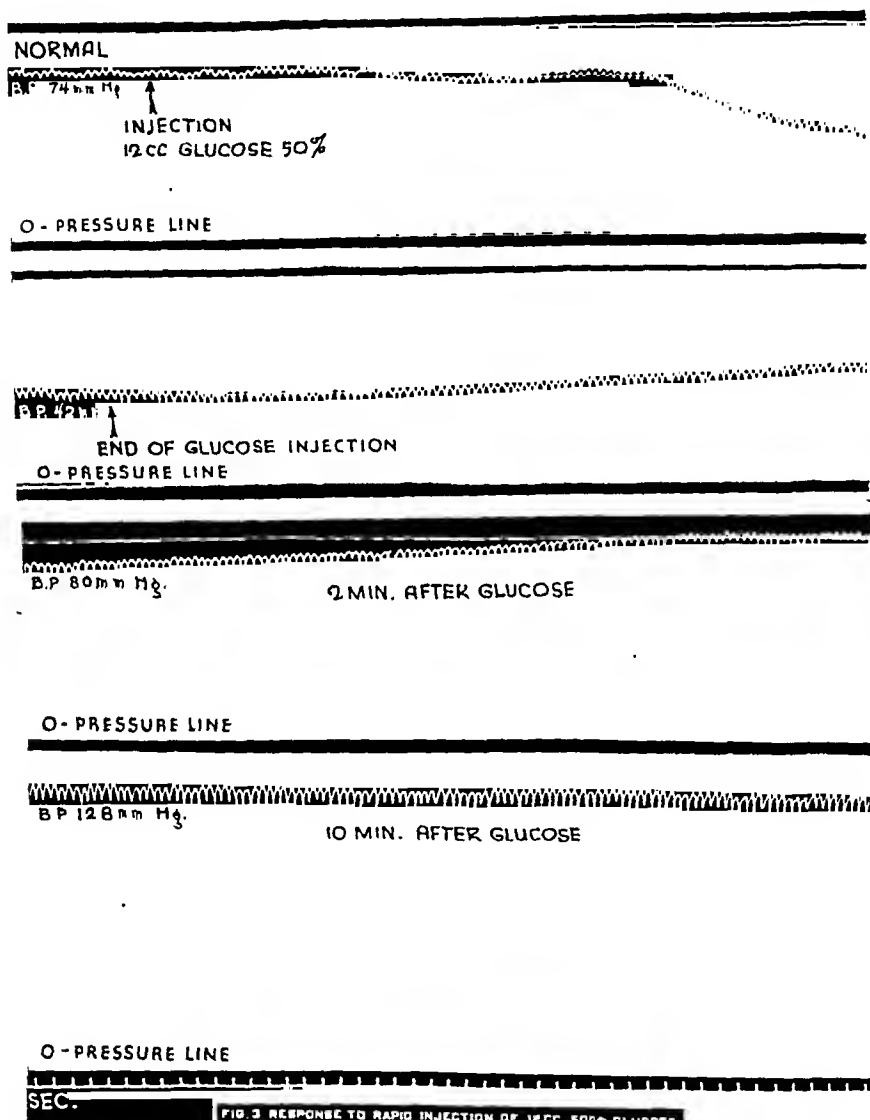
FIG. 2. RESPONSE TO SLOW INJECTION OF 50% GLUCOSE.

high point there was an average increase of 2 mm. Hg with an average maintained increase of 1.3 mm. Hg.

3. *Pulse Rate:* The pulse rate changes were not uniform. In one case the final rate showed no change, and in another it was above normal, both at the high point and during the maintained level. In one cat the rate at the beginning of the experiment was very high (295 beats per minute), and the fall observed was great (100 beats per minute). In the majority of cases the rate was slower than normal during the maintained pressure level.

*Slow Method.*—(10 cats).

1. *Blood Pressure:* In this group the primary rise and secondary fall were always absent. Following the injection of glucose the pressure began to rise, slowly and steadily, reached a high point, and dropped back a few millimeters to a maintained level. The greater the quantity of glucose given the greater the rise, although as before there was no definite ratio. There was, however, less difference between the high point and the maintained level than in the rapid method. The average high point was



26.4 mm. Hg with an average maintained level of 22.4 mm. Hg above normal, a difference of 4 mm. Hg as compared with a difference of 29.23 mm. Hg in the rapid method.

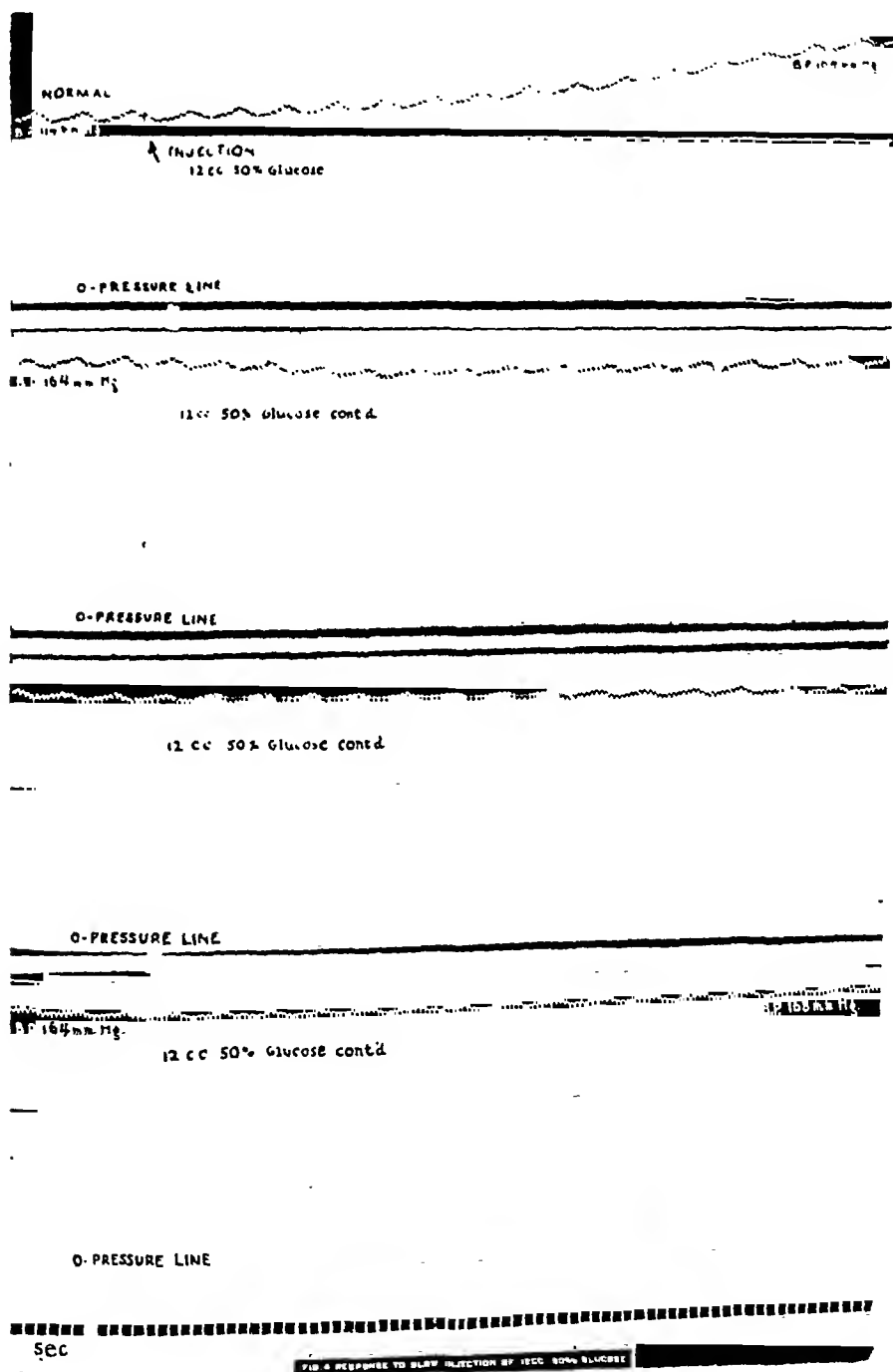
2. *Pulse Pressure:* The pulse pressure, as recorded by the manometer, showed a final increase over the normal. The average increase was approximately the same as that observed in the rapid method (1.3 mm. rapid; 1.6 mm. slow).

3. *Pulse Rate:* The rate changes were regular, much more so than in the rapid method. The final rate was always lower than the original rate; an average decrease of 14 beats per minute.



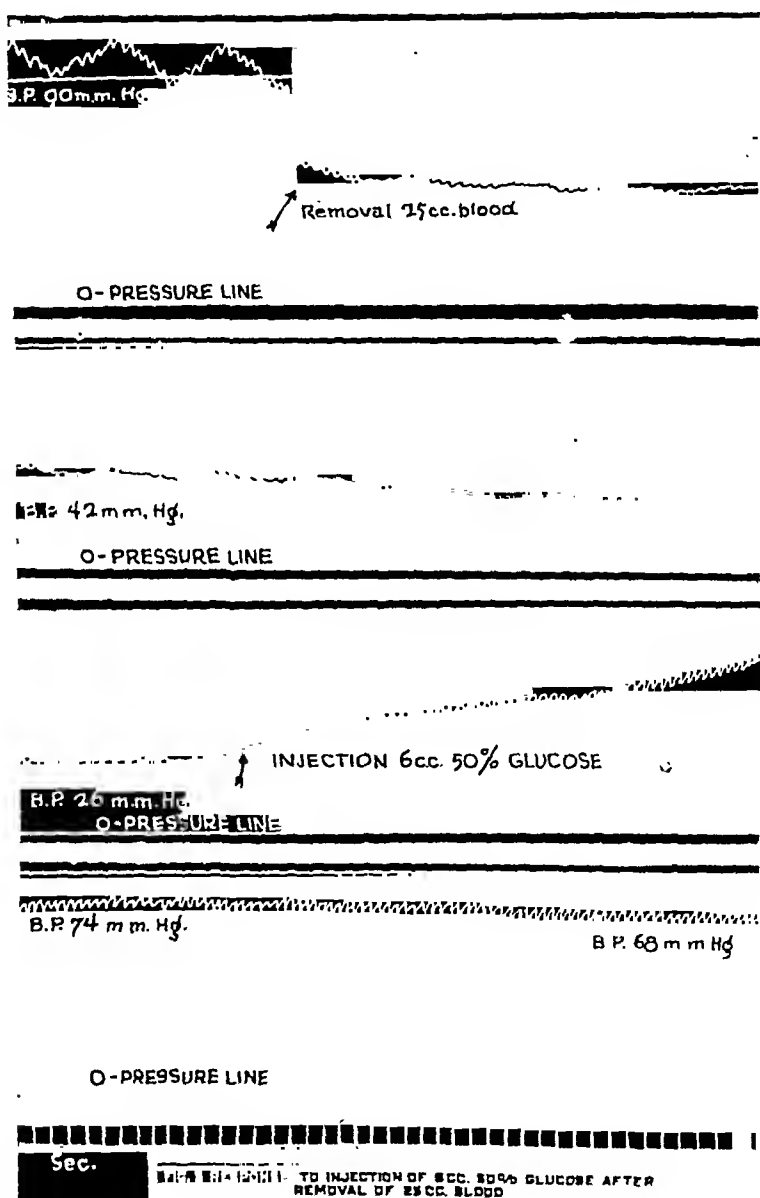
# GROUP II. CATS WITH BLOOD PRESSURE LOWERED ARTIFICIALLY BY HEMORRHAGE

In this study the blood pressure was lowered by experimental hemorrhage and trauma, again in two groups; one in which the cats had had previous glucose and one in which no glucose had been given, and 50 per cent glucose was injected subsequent to hemorrhage.



*Hemorrhage (20 cats)**A. Without Previous Glucose (10 cats).—*

1. *Blood Pressure:* Sufficient blood was drawn to produce a marked fall in blood pressure. An average of 26.66 c.c. of blood were removed, producing an average fall of 46.66 mm. Hg. Subsequently 6 c.c. of 50 per cent glucose were injected intravenously. Following the glucose injection the pressure began to rise, slowly and steadily, with-



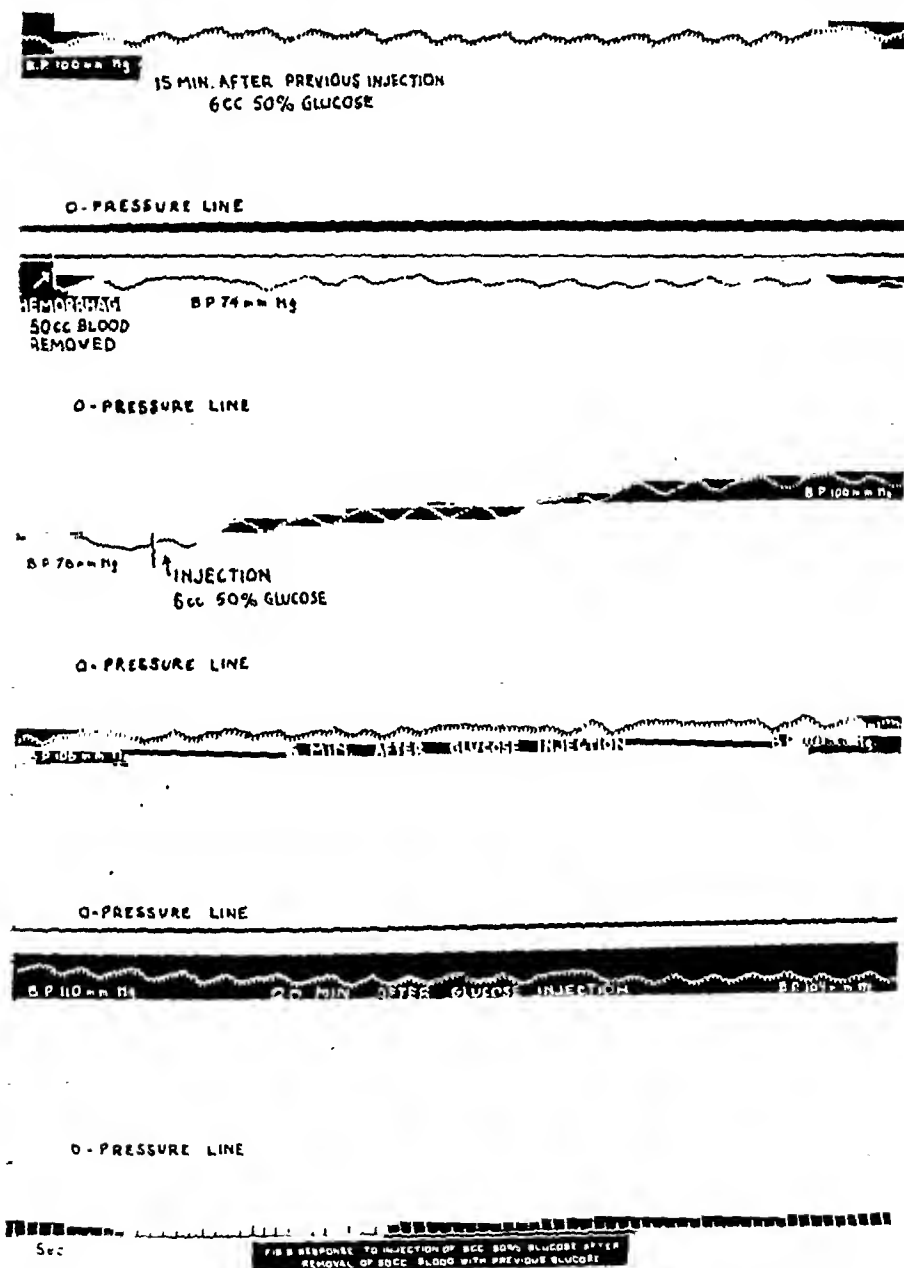
out the appearance of either primary rise or secondary fall. Both of these phases have failed to appear even when the rate of the injection was rapid. The total rise in blood pressure in no instance was sufficient to bring it back to normal. However, there was in every case an appreciable rise, and the average gain was 32 mm., or almost 70 per cent of the loss due to hemorrhage.

2. *Pulse Pressure:* The pulse pressure showed a definite increase in every case, an average of 1.34 mm. Hg.

3. *Pulse Rate*: The pulse rate was always diminished and maintained at a point considerably below normal (an average decrease of 25 beats per minute).

B. *With Previous Glucose* (6 c.c. of 50 per cent) (10 cats).—

1. *Blood Pressure*: An average of 56.66 c.c. of blood were drawn to produce an average fall of 45 mm. Hg. Subsequently 6 c.c. of 50 per cent glucose were injected intra-



venously. The rise in blood pressure which followed averaged 37.66 mm. Hg or 83 per cent of the loss due to hemorrhage (an average difference of 8 mm. Hg).

2. *Pulse Pressure*: The pulse pressure showed an increase, although it was not as great as in the previous group (3.3 mm. to 3.5 mm.). For all practical purposes, the normal pulse pressure was reestablished.

3. *Pulse Rate*: The final rate was approximately the same as normal. In the ani-

mals, which received glucose prior to hemorrhage, the pulse rose slightly, but readily returned to normal after the injection of further glucose.

#### DISCUSSION

The rate of infusion of 50 per cent glucose into the vein of a cat seemed to be the factor which determined the blood pressure response to that fluid. When the rate of infusion was fast, or at least as fast as 8.5 c.c. per minute, the blood pressure showed four definite phases; namely, a rise (primary), a fall (secondary), a second rise (tertiary), and a final fall to a maintained level. If the rate of injection was slow the first two phases were not present. There was an immediate, slow rise, resembling in some respects the tertiary rise in the rapid method, except that it was more gradual. Following this rise there was a slight fall to a level that was maintained. As has been previously stated, intravenous injections from 2 to 25 c.c. were given, and the same phases appeared, depending only on the rate of injection. Quantity of infusion apparently played no part in determining the magnitude of the primary rise. Small amounts frequently produced the greatest rise. The other phases did show some relation to quantity, although no definite ratio existed. When the pressure finally reached a level at which it was maintained, it usually was above the previous normal. With the slow method of injection it was more apt to be higher above normal than with the rapid method.

With either method of injection the pulse pressure showed a tendency to increase. The relation of final pulse pressure to normal was about the same in both methods. In no instance was it reduced below normal.

With the rapid method of injection, changes in the pulse rate were not regular. As a rule the rate was decreased. In one case it was decreased one-third. However, this cat had an unusually high rate at the beginning of the experiment, and with that degree of reduction, the final rate was still high. With the slow method, there was always a slowing of the rate.

The mechanism producing the fluctuations in blood pressure observed with the rapid method of injection is not clear, especially when the saline control, given in the same quantity and at the same rate, failed to produce any such fluctuations. A comparison of findings in a single case will illustrate the difference. In Case 12, a saline control of 12 c.c. was injected prior to the 12 c.c. of 50 per cent glucose. The saline was given at the same rate as the glucose which followed. At the beginning of the experiment, the systolic pressure was 74 mm. Hg. Twelve seconds after the saline injection was started the systolic pressure was at 80 mm. Hg, a rise of 6 mm. Hg. Four minutes later the systolic pressure was at 78 mm. Hg, ten minutes later 76 mm. Hg, and five minutes later it was 74 mm. Hg, back again to the original level. The rise and fall were gradual. Total injection time one minute. With the injection of glucose the pressure rose to 75 mm. Hg and then started to fall. In thirty seconds the systolic pressure was 39 mm. Hg, a fall of 36 mm. Hg. Four minutes later the systolic pressure

was 120 mm. Hg, and ten minutes later 100 mm. Hg, 26 mm. Hg above normal. In other words, following the injection of glucose the blood pressure went through all four phases characteristic of a fast injection of glucose; following the saline the blood pressure went through changes *resembling* a slow injection of glucose. This suggests that the size of the molecule of the fluid injected, the concentration, or both are responsible for the fluctuations in the blood pressure. The weaker the solution with the smallest molecule produced far less change than the more concentrated solution with the larger molecule.

Injection of 50 per cent glucose in cats with an artificially reduced blood pressure produced a characteristic reaction in all cases. There was always a rise in blood pressure, an increase or a return to the original pulse pressure, and a slowing or a return to the original pulse rate.

In those cases where the blood volume had been actually reduced by experimental hemorrhage, there have been certain definite findings. Cats that had received glucose previous to bleeding reacted to hemorrhage much better, at least from the standpoint of blood pressure, than those cats that had not received glucose, the final pressure level being much closer to the previous normal. At no time did we find anything resembling the previously described secondary fall, irrespective of whether the cats had or had not received preliminary glucose. In many instances the rate of injection was as high as in the rapid injections of Group I.

The administration of glucose after hemorrhage always increased the pulse pressure. The final pulse pressure was closer to the original when glucose had been given previous to the hemorrhage than in those cases where no initial glucose was given.

The pulse rate, which was increased by the bleeding, was always slowed after the glucose was injected. When glucose had been given before the hemorrhage, the final pulse rate was nearer to the normal than when no glucose had been given initially.

These findings would indicate that the diminished blood pressure, the rapid pulse, and the fall in pulse pressure, subsequent to hemorrhage in the experimental animal, can be combated, at least in part, by the intravenous injection of 50 per cent glucose. If hemorrhage is anticipated and a fortifying dose of 50 per cent glucose is given, the bleeding produces far less effect on the circulation than would otherwise be encountered.

#### SUMMARY AND CONCLUSIONS

As a result of our findings we conclude that:

1. Fifty per cent glucose injected intravenously into cats with a reduced blood pressure, produces a final sustained rise in blood pressure.
2. It causes a sustained rise in pulse pressure.
3. It produces a sustained reduction in pulse rate.
4. Slow injection is preferred to rapid injection.

5. Preoperative injection of 50 per cent glucose diminishes the fall in blood pressure due to hemorrhage.

Note: We wish to express our appreciation to Mr. Andrew Vanore for his assistance during the experimental procedures.

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150 CLINTON STREET.

## CONIZATION OF THE UTERINE CERVIX\*

MORTIMER N. HYAMS, M.D., F.A.C.S., NEW YORK, N. Y.

(From the Department of Gynecology, New York Post-Graduate Medical School and Hospital, Columbia University)

EFFECTIVE treatment of chronic endocervicitis is predicated upon a correct diagnosis, a clear conception of the histopathologic changes following infection, and the utilization of various methods of treatment. No single method is universally applicable. Complete removal of an infected area is an ideal method of cure, but obviously this often carries an implication of damage to the integrity of adjacent tissue or impairment of subsequent function. Any therapeutic method which approaches this desideratum without deleterious after results, either structural or physiologic, seems worthy of consideration.

In 1926 I made an exhaustive review of the literature of endocervicitis and its treatment, and surveyed the then available curative procedures. Those which seemed most efficient were cauterization, coagulation, diathermy, Sturmdorf tracheloplasty, and cervical amputation. A simple

\*Read, by invitation, before the New York Obstetrical Society, November 8, 1932.

erosion, with ectropion, free from evidence of infection is probably best treated by means of linear striping with a fine cautery tip, but if the interior of the cervical canal is cauterized sufficiently to destroy deeply infected glands, sloughing, secondary bleeding and extensive cicatrization may follow. Coagulation diathermy will destroy the infection but will also jeopardize the integrity of the portio in general, as the depth of heat penetration cannot be controlled. The Sturmdorf tracheloplasty has yielded excellent results in many cases, especially when the portio has been deeply and irregularly lacerated, but anesthesia and hospitalization are necessary, and as Wolfe<sup>1</sup> has recently demonstrated, islands of infected

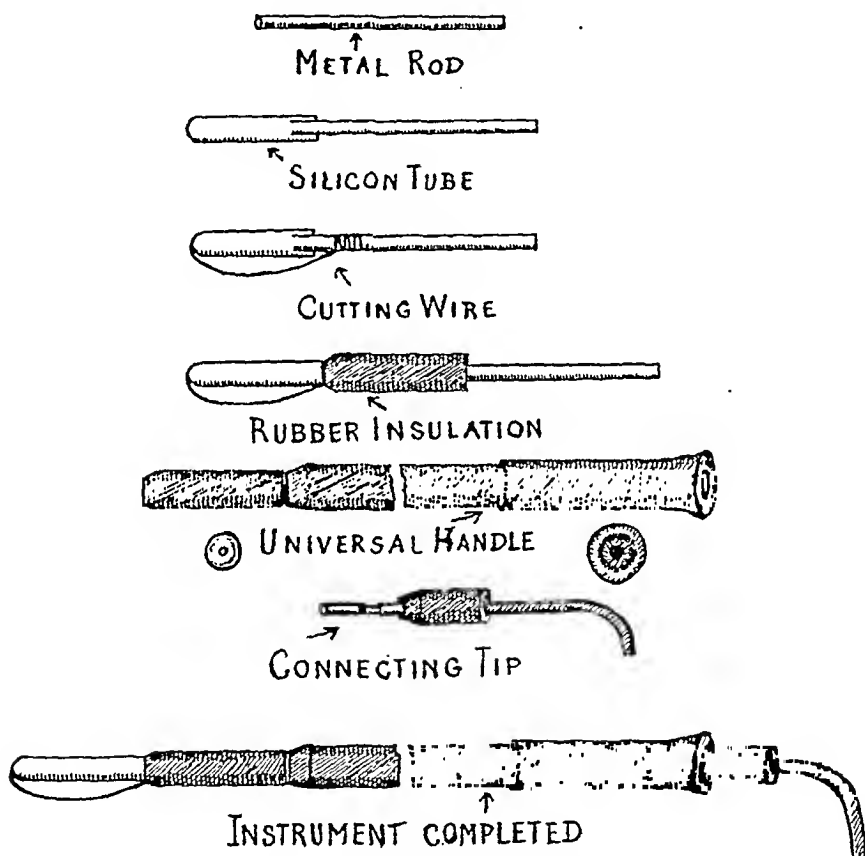


Fig. 1.—Construction of instrument.

glands are frequently left in the region of the internal os. Marked cystic degeneration, hypertrophy, or elongation of the cervix, especially if the patient is at or near the time of the menopause, are definite indications for partial or complete amputation.

The procedure now known as conization was originated and developed to insure complete excision of the diseased endocervix without injury to the underlying stroma and musculature, and with a minimum of operative detail and the elimination of hospitalization. Essentially, this consists of cutting out the core of diseased tissue by means of a fine, smooth high frequency current. An electrode for the intracervical maneuvers was de-

vised and adapted to the normal fusiform configuration of the cervical canal and the depth of its compound racemose glands.

The instrument was originally described and presented before the Section of Obstetrics and Gynecology of the New York Academy of Medicine in May, 1927.<sup>2</sup> In a paper read before the American Congress of Physical Therapy in November, 1929, 111 cases in which the instrument had been used, were reviewed.<sup>3</sup> A third paper was read before the New York Electro-Therapeutic Society in May, 1930.<sup>4</sup>

The instrument consists of the following parts (Fig. 1):

1. A metal rod, two and a half inches long, and one-eighth inch in diameter;
2. A silicon tube one and a quarter inches long, securely attached to the proximal end of the metal rod;

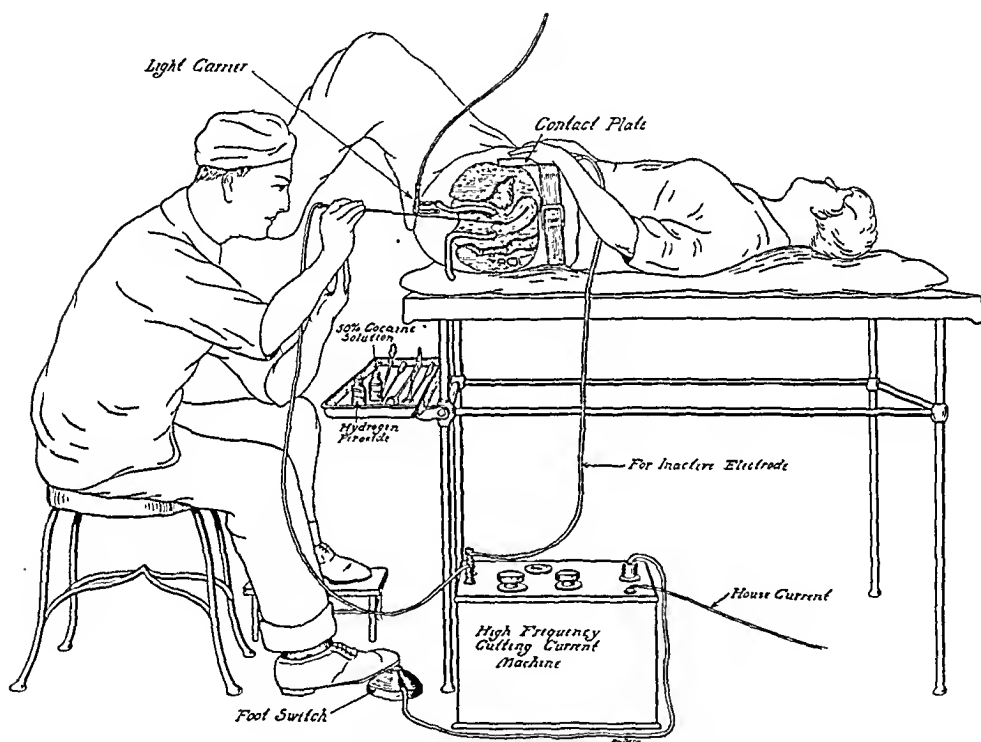


Fig. 2.—Schematic drawing of surgeon and patient during conization.

3. A fine tungsten wire, attached at the metal-silicon junction, with its other end fitted into the distal extremity of the silicon tube. This wire is not straight, but describes an arc with its widest portion one-eighth of an inch away from the silicon tube. It conforms to the spindle-shaped contour of the cervical canal.

4. An insulating sheath of hard rubber covers the metal-silicon junction and the proximal half of the metal rod.

The instrument fits into an insulated universal electrode handle which is seven and a half inches long. A connecting tip of swivel action is attached to the distal portion of the handle, to provide contact with the conducting wire from the high frequency apparatus.

The patient is placed and draped on the examining table in the usual manner. The cervix is exposed and illuminated with a bivalve speculum, fitted with the Hyams light carrier. The vaginal fornix and cervical canal are swabbed with hydrogen peroxide to rid them of discharge, and wiped dry. A small crystal of cocaine hydrochloride is



placed in the cervical canal and allowed to dissolve, or an applicator saturated with 50 per cent solution of cocaine is inserted into the cervical canal and left for five minutes. This local anesthesia is sufficient to permit painless conization and is apparently free from untoward effects. An inactive, wet metal electrode about six inches square, connected to the high frequency machine, is placed on the lower abdomen and held there firmly by a strap or sand-bag (Fig. 2). The patient is directed to make firm compression with both hands, to create an even contact and to distract her attention. The depth of the cervical canal is then measured and an appropriate instrument selected. This active electrode is connected to the other pole of the high frequency machine by a second conducting wire. The current is turned on sufficiently to provide the proper quantity for the operation. The instrument is held firmly in the right hand and the other hand steadies it. The tip of the instrument is held about one-eighth of an inch away from the external os, and the foot switch closed, thereby completing the electrical circuit which creates a spark. With the current still flowing, the silicon portion of the instrument is passed into the cervical canal to the internal os, allowing the spark to cut its way through the tissue. The diseased mucous membrane is then coned out by rotating the electrode 360 degrees (Fig. 3). After releasing the foot switch and withdrawing the electrode, the diseased endocervical tissue will be found adhering to the tungsten wire and the silicon tube, or is removed with a dressing forceps, and a few drops of blood

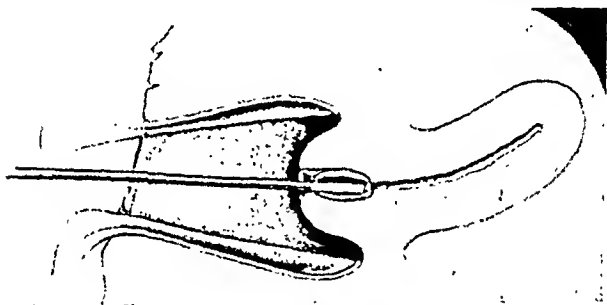


Fig. 3.—Removal of the diseased endocervical tissue.

may appear in the canal. If the first cone removed, fails to include all the infected mucous membrane, more tissue may be cut away by the reintroduction of the instrument and repetition of the process. On completion of the operation an applicator saturated with 2 per cent mercurchrome solution is placed in the cervical canal and left for several minutes. A light vaginal mercurchrome gauze packing is adequate to control the slight bleeding which might occur. Four days after conization, a thin, grayish film will sometimes be found in the cervical canal. The raw surfaces are swabbed with mercurchrome. By the seventh day, the cervical canal will be found smaller and granulation tissue appears. After two or three weeks, the cervix approximates its normal size, but a few small unhealed areas may still be evident. Four weeks after operation, the eroded areas are usually completely covered with epithelium and the entire cervix looks healthy. Vaginal douches are inadvisable and unnecessary.

I have practiced the described technic in 547 cases during the past five and one-half years, and 232 additional patients have been similarly treated by my co-workers at the New York Post-Graduate Hospital, making a total of 779 cases on which to base this presentation. We are all in accord that conization is not a panacea for all cases of chronic endocervicitis, and candidates must be selected with discrimination. The best results are observed in patients suffering from chronic endocervical infection with extensive glandular involvement but without complicating features.

In 12 cases, it was necessary to repeat the operation after several months, probably because some infected glands had been left in situ at the original sitting. This is partially explained by the extreme caution exercised in our early experience. I would urge, however, that it is advisable for any one who employs the method to be very careful until his proficiency is developed. In properly selected cases, conization may be relied upon to cure leucorrhea and backache of endocervical origin and to eradicate infections of the endocervical glands. The economical features and simplicity of the method appeal to the patient, as general anesthesia, hospitalization, and loss of occupational time are all obviated. The procedure is painless and does not even cause discomfort.

Bleeding sufficient to cause anxiety or to incapacitate the patient has not occurred in any of the cases in which the correct technic has been followed. In about 2 per cent, there was slight oozing for a few days. The bleeding at the time of operation can always be arrested by the mereurochrome vaginal pack. There have been no inflammatory pelvic complications, as only chronic infections of the cervix have been treated. Conization is not advocated until after an acute inflammation has subsided and the active process has become quiescent.

A careful, conscientious, and unbiased follow-up of our series of 779 cases treated by conization, shows that 90 per cent have been relieved of their symptoms and now present a healed and apparently normal cervix. Some of these patients have been observed at frequent intervals for five years or more. Pregnancy occurred in 27 patients, although none of them had been treated with conization with the deliberate purpose of curing sterility. It is logical however, that removal of the cervical infection should favor impregnation. None of the labors in these cases was unduly prolonged or difficult. In several, the labors were conducted by my associates, and in others, the hospital records indicated that the cervix dilated normally and without undue laceration. One of my colleagues has performed conization during the early months of pregnancy to relieve a profuse cervical discharge. While no untoward results were noted, I cannot endorse this practice. The endocervix was coned out in a number of patients in whom the presence of *trichomonas vaginalis* could be demonstrated, but the persistence of leucorrhea and *trichomonas* was convincing evidence of the futility of the procedure as a curative agent.

Extraneous lesions to which the endocervicitis is secondary must be dealt with before treating the cervix locally. The circulatory stasis incidental to a uterine retrodisplacement or subinvolution sometimes gives rise to symptoms similar to those of endocervicitis. Under these circumstances, conization will not only fail to arrest the leucorrhea and backache, but may even intensify them. When the cervicitis is only a concomitant of other pelvic conditions, such as inflammatory involvements of the urogenital tract, fibromyomas, retained decidua, myometrial fibro-

sis, endometrial polyps, etc., particularly if no real infection is present, conization is not indicated. The fact that it was performed in such cases in my early experience without bad after-effects, is no criterion that exact diagnosis and indications for the method are not of paramount importance.

The instrument used must conform to the anatomical contour and length of the cervical canal and the histologic character of the lining membrane, which is one-eighth of an inch in depth and rests upon the basement membrane. Modifications of the Hyams electrode have been devised which do not duplicate the original specifications. Too much projection of the wire beyond the proximal end of the silicon tube forms an irregular circular loop, which in use, gouges out the tissue, cutting a cone equal to its diameter through the internal os and the surrounding structures. This results in coagulation, postoperative hemorrhage, slough, and severe irritation of the underlying tissue.

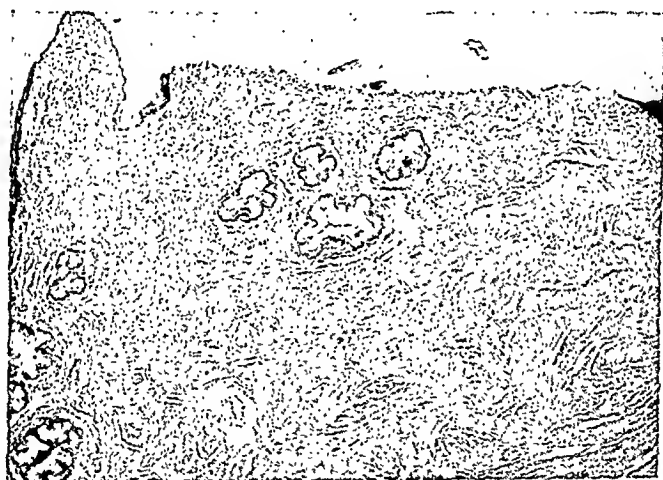


Fig. 4.—Microscopic section of cervix, low power magnification, showing tissue removed by conization. Note minimum amount of trauma.

The proper instrument should be operated from a high frequency machine incorporating a special unit which generates a fine, smooth cutting current. This machine may be either of the gap or radio tube type. Some of the units made for supplying electrical energy, produce a current so intense as to not only burn the tissues, but also to coagulate and even cauterize, instead of delivering a fine cutting current with a minimum of coagulation. Destruction of tissue with subsequent stenosis is not unusual under these conditions. The right current is just as indispensable as a perfectly designed wire electrode. Those failures and undesirable results which have been reported, have been unjustifiably attributed to the method rather than the real cause: poor equipment, improper technic, or misapplication in unsuitable cases. A case was recently brought to my attention, which almost terminated fatally after an attempted conization with a faulty instrument and a coarse cutting current, in a patient with an acutely anteverted uterus. The operator

burned and coagulated completely through the internal os and perforated the lower uterine segment, passing the electrode into the peritoneal cavity. In another instance, cicatricial stenosis was unfairly blamed on conization. Investigation disclosed that a high frequency apparatus delivering a hard, coarse current of too high intensity was used, resulting in severe burning and coagulation, with subsequent stenosis. As a matter of fact, conization has been used successfully in relieving both partial and complete stenosis. In my own cases and those of my coworkers, there has not been a single instance of stenosis. On the contrary, the natural



Fig. 5.—Microscopic section of cervix, low power magnification, six months after conization.

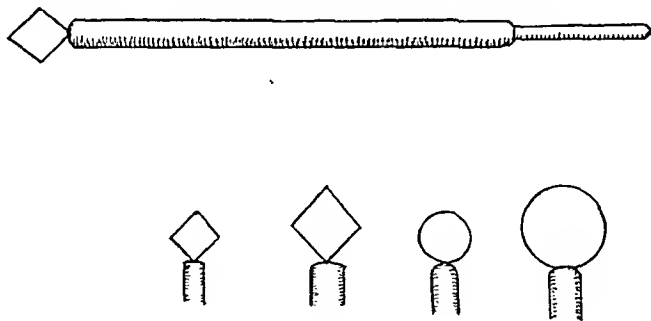


Fig. 6.—Loops used for biopsy of cervix.

reparative processes are aided and healing expedited. The muscular tissue remains intact and there is practically no scar formation (Fig. 5).

The conization technic is particularly well adapted to securing biopsy specimens of tissue from the cervix, as pain and the necessity for dilatation are avoided. Although the standard conization electrode may be used, special small square and round electrodes of different sizes were devised for this purpose (Fig. 6). These loops are ideal for suspected cases of carcinoma, especially when the cervix is relatively inaccessible and cannot be reached with the usual instruments. The incidental heat and absence of trauma are of material advantage. There is little danger

of scattering malignant cells into the adjacent lymphatics and secondary bleeding is insignificant (Fig. 7).

In closing, I wish to emphasize that the technic can be utilized in the gynecologist's office, that tissues can be removed to any desired extent, and the procedure may be repeated if necessary to excise the diseased

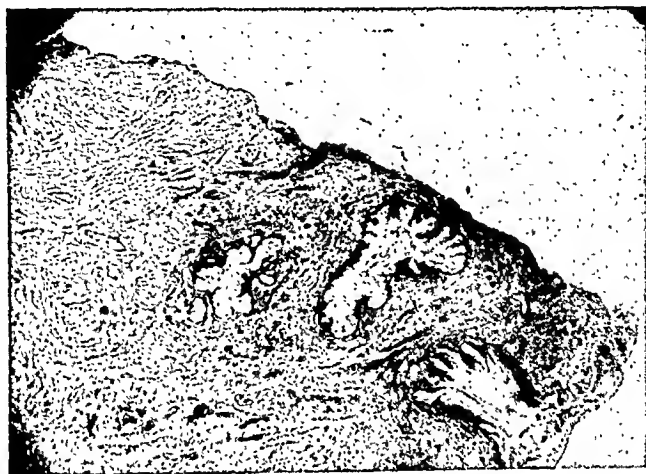


Fig. 7.—Microscopic section of cervix, removed for biopsy. Note minimum amount of trauma.

area completely. With correct equipment, the cutting proceeds smoothly, the tissues are divided accurately, and the generated heat assures asepsis. Most important of all, however, is the dictum that the patient must always be adapted to the procedure, and not the procedure to the patient.

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78 EAST SEVENTY-NINTH STREET.

#### ABSTRACT OF DISCUSSION

DR. WALTER T. DANNREUTHER.—I desire to verify the statements that Dr. Hyams has made and to emphasize a few of the important points. First, we have now accumulated a tremendous number of these patients in our clinic, and I have seen the after-results two, three, four, or five years after conization. I can only add that they are all that the pictures show them to be. However, I think it is wise to reiterate that this method is not applicable to all cases of endocervicitis indiscriminately, and Dr. Hyams is to be commended in that he has recognized that fact. As he said, in the case of a severe deep laceration with extensive cystic disease, where perhaps a primary pyogenic infection was not a factor of importance and the woman is at or near the menopause, we still feel that the cervix is better amputated or removed as part of a total hysterectomy. Again, a simple erosion in a young girl, or in a young married woman without pelvic infection is, as he said, probably best treated with linear cautery stripping. I firmly believe that the results from this method of extirpation of the diseased endocervix are far superior to those of the Sturmdorf tracheloplasty; we get better results, it is a much simpler procedure, and does not involve hospitalization. Of course, the two patients on whom the method was demonstrated in the motion picture were afterwards operated upon for the prolapse, and

conization was carried out in these two cases only to facilitate the demonstration of the details of the technic.

DR. ISIDOR C. RUBIN.—I was interested in the biopsies done six or eight months after the initial treatment. After all, we have to think further than the immediate result with this treatment. We can accept the doctor's statement that the diseased endocervix is extirpated by this method, that it is a bloodless, painless, ambulatory method and, I believe, the most ingenious so far devised.

I would like to ask Dr. Hyams if he has seen sections of the whole cervix. The sections that we saw tonight showed stratification of the epithelium lining the cervical canal; but these were from biopsies. This method would appear to be applicable to patients approaching the menopause or thereafter. But from what I have seen, both of his work and in the short experience I have had with his method, it no longer appears necessary to amputate the cervix in the case of multipara for erosions, lacerations, and eversion. The cervix can be cleaned up, the canal eventually becomes epidermized and a satisfactory healing takes place. I should hesitate however to subject nulliparous women who are desirous to bear children to this radical treatment for the relief of a leucorrhea or even endocervicitis. Dr. Hyams mentioned the fact that in some 20 odd cases pregnancy has followed the treatment and no dystocia was noticed at the time of labor. It seems to me it would be important to know how many of his 500 odd cases were nulliparous women who, though anxious to have children, nevertheless did not become pregnant.

The question that concerns me most is that of stenosis, which Dr. Hyams says has been excluded in his experience. Until one acquires such an experience one may produce a permanent barrier against conception.

DR. HYAMS (closing).—The greatest number of patients treated have had one or more children. In a previous summary, we concluded that chronic endocervicitis occurred more frequently after abortion, miscarriage and childbirth, rather than following gonorrheal infection.

There are many causes for sterility. Occasionally a profuse cervical discharge may prevent or make impregnation difficult. Conization is performed to relieve the discharge and not for relief of the sterile condition. It is logical to assume that removal of the infection should favor impregnation and of the 27 patients who became pregnant following this modality, none was treated primarily for sterility. To cite a specific instance: Mrs. S. presented herself in 1927 complaining of a profuse vaginal discharge and also sterility. Conization was done to eradicate the chronic endocervicitis present. Shortly after, she became pregnant, and in the early part of 1928 her accouchement took place at the Fordham Hospital. The hospital records revealed an uneventful delivery of a normal child with no dystocia or undue laceration of the cervix. In another instance, a patient with chronic endocervicitis became pregnant following conization of the cervix. One of my associates at the New York Post-Graduate Hospital had her registered on his service at the Long Island College Hospital where he, personally, could follow her parturition. He reported a normal delivery and stated that no one would ever know that anything had been done to the cervix. In no instance, to my knowledge, has there been dystocia or a prolongation of the labor or excessive laceration of the cervix from scar tissue as a result of the previous treatment.

The treatment of chronic endocervicitis in the nulliparous woman is sometimes very difficult. Linear striping of the endocervical tissue with a fine cautery tip often gives excellent results. Dr. Dannreuther has emphasized the point that this method has not been discarded by us.

It is our purpose to make a correct diagnosis and select the appropriate treatment. The best results are based on eradication of infection with a minimum trauma to the cervix, and this we believe is best achieved by the proper use of conization.

## THE MECHANISM AND MANAGEMENT OF THE THIRD STAGE OF LABOR\*

MURRAY L. BRANDT, M.D., NEW YORK, N. Y.

**B**AUDELOCQUE, recognizing the normal processes of the third stage of labor, is credited with being the first to distinguish between separation and expulsion of the placenta. As early as 1799 Osiander talks of "expression" of the placenta and in 1820 he described a maneuver resembling the Credé Method, assisting this with traction on the umbilical cord. However, little attention was given to this period of labor until Credé presented his own mode of management in 1853. This became popular immediately and remained the accepted manner of procedure until Ahlfeld, Dohrn and others began their attacks on the Credé manipulation, advising an entirely opposite method of treatment. For many years this controversy raged and although compromises have been offered, the final solution of the problem has not yet been reached.

As the child is being expelled, in a normal labor, the size of the uterus diminishes partly as a result of muscular tone and partly due to uterine muscle contraction. As a result of this change the veins in the muscle layer of the uterus are compressed so that maternal blood in the placenta can not escape from the uterus. At the same time the reduction in size of the uterine cavity has squeezed the placenta so that the blood in the intervillous spaces is forced into the veins of the decidua. We therefore have a layer of overdistended veins in the decidua spongiosa, lying between a firmly contracted uterine wall and a more or less solidly compressed placenta. As a result of this vise-like compression, the congested venous sinuses burst and the extravasated blood under tension causes tearing of the very fine septa of the spongiosa, thereby detaching the placenta from its uterine site.

For this normal mechanism to occur, the factors mentioned above, i. e. contracted uterine wall and compressed compact placenta, must be present. If either of these is absent, separation does not follow a normal course. If the uterus does not contract as the child is being born, then separation does not occur until an after-pain has set in, causing reduction in the size of the uterine cavity as well as contraction of the muscular wall of the uterus. On the other hand, if the placenta is thinned out and covers an area much larger than normal, there does not develop the usual counter resisting mass of compressed compact placenta, hence separation is delayed.

As the separated placenta is detached from its uterine site, it folds on itself, but it is held in the uterine cavity because of the firm attach-

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\*Read, by invitation, at a meeting of the New York Obstetrical Society, December 13, 1932.

ment of the membranes. If the uterine contraction, that has separated the placenta, is strong, the placenta may be expelled into the lower uterine segment and upper vagina, the placenta acting as a foreign body. If pituitrin is given at the end of the second stage of labor, this mechanism is the rule. When this occurs, the retroplacental hematoma does not form and could have no function.

If however, after placental detachment, with the membranes still firmly adherent, the separating pain is not strong enough to force the placenta out of the uterine cavity, bleeding both from the intervillous spaces of the placenta and from maternal sinuses takes place during the following uterine relaxation.

The subsequent uterine contraction acting on the increased bulk as on an hydraulic wedge forces the placenta down into the lower segment, peeling the membranes off the uterine wall at the same time. Manipulation of the uterus at this time may detach the membranes at one point so that the retroplacental blood escapes without completely detaching the membranes at the placental border, resulting in retention of the placenta, with increased bleeding.

In a series of 30 cases in which we injected the umbilical vein with a solution of sodium iodide, immediately after the birth of the child we found the placenta detached and folded on itself in every case lying in the lower segment of the uterus. X-rays were made within three minutes of the delivery of the baby. We used an amount of solution equal to the quantity of blood that flowed from the severed cord, an average of 50 c.c.

A century ago, it was the recognized procedure of experienced accoucheurs to deliver the placenta by traction on the umbilical cord, after separation, as corroborated by vaginal examination, had been established. Although Credé in 1853 agreed that in the hands of accomplished obstetricians, this was a satisfactory method, he showed that complications were frequently encountered by the unskilled. To prevent these and to obviate the necessity for vaginal interference, he devised a method of manual compression of the uterus at the height of contraction, expressing the placenta thereby. In his early work, he waited fifteen to thirty minutes for uterine contractions to occur, but in 1861 he concluded that it was better to express the placenta as soon as possible after the birth of the child. This mode of delivery still has its followers today.

Ahlfeld working with Credé found that the same complications that his teacher had condemned in the cord traction method, occurred not infrequently when the expression maneuver was performed by incompetent midwives. He therefore postulated his famous doctrine of "Hands off the uterus," the complete antithesis of Credé's teachings. Ahlfeld stated that his expectant treatment provided time for the development of a retroplacental hematoma which would completely separate the placenta, act as a tampon allowing thrombosis of the vessels of the placental



site and prevent the entrance into the uterus, of bacteria from the vaginal canal.

We know today that his premises were wrong, that the retroplacental hematoma is not necessary for placental separation, that thrombosis of the vessels of the placental site is usually considered pathologic and that the empty parturient canal is the best prophylactic against puerperal infection.

When it was found that indefinite waiting for spontaneous expulsion allowed an excessive loss of blood and that only 14 per cent of cases delivered the placenta without some assistance, the method was modified by arbitrarily limiting the period of expectancy and then applying the Credé expression.

Many obstetricians, especially Americans believe that in these methods there is an unnecessary waste of time and that the placenta can be safely delivered as soon as it is definitely shown that it has completely separated. The establishment of placental separation in this method precludes the dangers inherent in Credé's original technic. The plan of treatment is watchful control of the uterus with expression when signs of descent are present.

However, all methods of compressing or pushing the uterus downwards towards the pelvic cavity are unnatural because not only do they contuse and bruise the uterine wall, but they cause a passive congestion of the uterus which may produce bleeding during the subsequent relaxation.

It may be impossible to express the separated placenta from the uterine cavity, by any of the usual methods because of closure of the cervix. The only treatment required is waiting until this contraction has relaxed, and repeating the necessary maneuver to cause expulsion of the placenta. This is not infrequent especially after the use of pituitary extract.

Should the delay be due to failure of placental separation, three conditions must be differentiated. In the first, the placenta remains adherent because of lack of uterine contraction as is found in cases of overdistended uteri, in excessively long labors and after prolonged and deep anesthesia. In the second class are cases where the placenta covers a large surface area and is very thin, hence it does not offer sufficient bulk for the uterus to contract upon. In the third group are cases of pathologic conditions of placenta and decidua.

In the first group, methods of exciting uterine contraction are indicated after allowing some time to elapse for the uterus to regain its normal muscle tone. Here especially is pituitary extract of value. The routine injection of posterior pituitary extract, immediately after the completion of the second stage of labor, has found many advocates who report excellent results from its use. However, no uterine contraction caused by artificial means is similar to normal spontaneous contraction. The uterus is always in a state of tone and is never completely relaxed.

The normal lessening of tone following a normal spontaneous contraction is of lesser degree than the marked decrease of tone following a strong artificially induced uterine contraction. Secondary bleeding is more common and more profuse following such artificial contraction.

In the second group, the placenta failing to separate because of excessive thinness of its structure, offers an ideal condition for the use of the Gabaston method of injecting a solution into the umbilical vessels, increasing the weight and volume of the placenta. This procedure has received a great deal of trial and is in constant use in many of the large clinics.

If the Gabaston procedure fails to separate the placenta, manual exploration of the uterine cavity is the next logical step, to determine whether the placenta can be easily peeled off the uterine wall. If the decidua spongiosa is normally developed, a plane of cleavage will readily be found and the placenta can be removed in toto.

When true placenta accreta exists, no line of cleavage can be secured, for the spongiosa is either scanty or absent and the villi are anchored in the uterine muscle. In such cases complete removal is fraught with great danger of infection and hysterectomy is of life saving value.

Dickinson in 1899 had advised lifting the uterus high out of the pelvis by abdominal manipulation, in order to control postpartum hemorrhage. Fuchs in 1919 advised pushing the uterus upward to aid separation of the membranes.

In a recent very interesting and complete discussion of this subject, Smith describes the Dickinson-Pomeroy technic of management of the third stage. This method has given excellent results with an extremely low incidence of severe postpartum hemorrhage. Having used this upward lifting of the uterus for several years in controlling postpartum bleeding, I decided to use this same maneuver to aid the delivery of the separated placenta.

After the birth of the baby, attention is first directed to the care of the child. The perineum is cleansed and inspected to determine the necessity of repair and preparations made accordingly. During this time there is no abdominal manipulation. Five to ten minutes have now elapsed from the time of the birth of the baby and the separated placenta should be in the cervix and upper vagina.

An artery clamp is placed on the umbilical cord close to the vulva and held in one hand while the other hand is placed on the abdomen of the mother, in such a manner that the thumb lies parallel to the symphysis and palm and fingers approximate the surface of the uterine body. Holding the umbilical cord taut, a gentle upward push is made on the lower segment by the hand on the abdomen, without attempting to grasp the uterus. If the placenta lies in the dilated cervical canal or upper vagina, the uterus will rise upward and there will be but slight tension on the cord held in the artery clamp. If it rises, a further series of

gentle pushes causes the uterus to ascend towards the diaphragm while the placenta remains in the vagina. It is usually sufficient to raise the uterus to a level where the umbilicus is about at the middle of the uterine body. Frequently in performing this maneuver, one feels the membranes peeling off the lower uterine segment.

When the first upward push causes tension on the umbilical cord, no further attempt is made for several minutes. Persistence of upward pressure when tension is felt, is to be avoided, for it is similar in effect to traction on the cord. This failure of the uterus to rise when pushed, results most frequently from closure of the cervix holding the placenta, and one must wait for it to relax.

When the uterus has risen high in the abdomen, the placenta lying in the vagina is expelled by gentle downward pressure just above the symphysis. The uterus is held high, between the hands of an assistant for fifteen minutes, during which time the perineal repair is accomplished.

In this method of managing the third stage of labor, the uterus is not massaged, or squeezed and is therefore allowed to contract normally while the usual relaxations of the musculature are not so marked as those occurring in artificially stimulated uteri. The empty uterus contracts readily. The upward pull on the uterus causes stretching and narrowing of the vessels supplying blood to the uterus producing an anemia of its musculature, aiding firm contraction.

In a series of 800 obstetric cases in which this method of assisting the delivery of the placenta, was carried out, there was an average blood loss of 6½ ounces. In the 415 primiparas the loss was slightly higher than in the multiparas, averaging 7 ounces. There were 138 forceps deliveries, 113 of which were in primipara with an average loss of 13 ounces of blood. There were 10 cases in which bleeding was more than normal; 5 patients lost 22 ounces; 2 patients, 24 ounces; 1 patient, 34 ounces; and another of 36 ounces, while one patient had a severe bleeding with a loss of 60 ounces of blood. This last case was one of twin pregnancy in which the placenta separated after a delay of thirty minutes and was expelled in the usual manner. The patient bled profusely as a result of uterine atony. The uterine muscle did not seem to respond to pituitrin injections and intrauterine packing was finally successful in controlling the hemorrhage. The patient made an uneventful recovery. The other 9 cases of abnormal bleeding occurred in patients delivered by forceps.

The average duration of the third stage in this series of cases was eight minutes. There were three cases of delayed third stage. The first was the case of postpartum hemorrhage following delivery of twins mentioned above; the second case, after waiting one hour, no signs of separation having occurred, intrauterine exploration was done. The placenta was found to cover almost the entire surface of the uterus and

was very thin. A plane of cleavage was easily found and the placenta peeled off the uterus without any difficulty. This placenta was unusually large being  $10\frac{1}{2}$  inches in diameter and only one-half inch in thickness. Bleeding in this case was normal and the puerperium was uneventful. In the third case there was a bi-lobed placenta, each part being as large as a normal size placenta and connected together by one large vessel. In this case the placenta had separated but could not be expelled because of its unusual bulk. After attempting the lifting of the uterus method intermittently for thirty minutes, vaginal examination revealed the lower edge of the placenta in the cervix. A powerful Credé manipulation was required to expel this double placenta.

There was no death in this series. No injury of the cord, placenta, or membranes occurred in any case. Although the cord must be held taut, traction must be avoided. If the placenta has descended and is not held by the closed cervix, but slight tension will be felt as the uterus rises easily. The upward push on the lower segment and body of the uterus does not interfere with the normal course of placental descent though the manipulation may have been performed before the placenta was in the cervix.

This method of management of the third stage is presented for consideration with the hope that it may be given further trial.

2021 GRAND CONCOURSE.

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## INJURY OF THE URINARY BLADDER FOLLOWING IRRADIATION OF THE UTERUS\*

ARCHIE L. DEAN, JR., NEW YORK, N. Y.

*(From the Department of Urology, Memorial Hospital)*

IN 1927 the writer described ulceration of the bladder which occasionally followed applications of radium to the uterus. That paper was based upon the study of three patients. Since 1927, 47 women have been examined and treated for pathologic conditions of the bladder caused by irradiation of the uterus. In the earlier group, radium alone had been used, and in each case the bladder lesion was an ulcer. In the larger, more recent series, the majority of the patients were treated with the roentgen rays in addition to radium, and the bladder findings varied considerably although ulceration predominated. Therefore in the introduction to this study, we must attribute a certain etiologic importance to the roentgen rays, though it is a minor one, and recognize that the bladder injury following uterine irradiation may be of different degrees of severity.

Irradiation has become an approved method of treating several uterine diseases, benign as well as malignant. Facilities for the use of both radium

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\*Read, by invitation, at a meeting of the New York Obstetrical Society, December 13, 1932.

and the roentgen rays are almost universal. Even when these agents are employed conservatively by skilled operators a certain number of women subsequently develop injury of the bladder. This complication may be difficult to diagnose and treat. The patient may suffer great pain and the lesion, unless arrested, may cause serious injury or even death. For these reasons urologists and gynecologists should familiarize themselves with the condition.

TABLE I

DISEASE	NUMBER OF CASES TREATED	NUMBER WITH BLADDER INJURY	PER CENT WITH BLADDER INJURY
Carcinoma of cervix, primary	1474	31	2.10
Carcinoma of cervix, recurrent	82	6	7.31
Carcinoma of cervix, postopr. prophylactic	36	1	2.7
Carcinoma of corpus	151	3	1.92
Carcinoma of ovary	43	1	2.3
Fibromyoma uteri	798	3	0.38
Nonmalignant myopathic bleeding	457	3	0.65

It is difficult to learn the proportion of patients who receive bladder injury from uterine irradiation because the patient must live several years after irradiation before the injury appears. Unfortunately a substantial number of women do not survive so long. It is important to note that all of the patients but one of this series were free from symptoms or signs of the primary uterine disease at the time bladder injury was discovered.

#### ETIOLOGY

Bladder injury as a consequence of irradiation of the uterus is not primarily the fault of unskilled operators. In fact each patient in this series was treated by a gynecologist of experience. These surgeons were aware of possible bladder complications and took all known precautionary measures.

Nothing was found in the general examinations of these patients which might suggest that they were abnormally sensitive to radiation. Pelvic examinations did not show that radium placed in the cervical canal or uterine cavity would be unusually close to the bladder.

Bladder injury may follow irradiation of any uterine disease. This series included the following:

Carcinoma of cervix		Postoperative prophylactic	1 case
Primary early	10 cases	Carcinoma of corpus	3
Primary borderline	6	Carcinoma of ovary	1
Primary advanced	15	Fibromyoma uteri	3
Postoperative recurrent	3	Chronic endometritis	1
Postradiation recurrent	2	Chronic endocervicitis	2

By comparison with all of the women treated in the same time interval, we find that the figures shown above represent the percentages indicated in Table I.

Irradiation of uterine tumors has largely become standardized. Minor variations in management may occur because of personal preference, differences in the applicators available, or peculiarities of individual tumors. Healy has described the methods used at the Memorial Hospital. His applicators are listed below together with the doses usually prescribed. If we assume that the base of the bladder is an average distance of 2.5 cm. from the source of radiation, it is not difficult to compute the number of skin erythemas which the bladder receives from radium. Penetration of the roentgen rays to the bladder is indicated as well.

TABLE II

SOURCE OF RADIATION	USUAL DOSE	S. E. D. RECEIVED BY BLADDER
Pelvic Cycle H-V roentgen rays	4 Exposures (2 ant. 2 post.) 700-800 r each	1.2
Vaginal applicator	1,000 mc. hr. to rt. lt. and center pelvis (total 3,000 mc. hr.)	3
Cervic tandem	3,000 mc. hr.	3
Fibroid tandem	3,000 mc. hr.	3
Stem and base applicator	3,000 mc. hr.	3

When gold seeds are used to furnish interstitial irradiation, the bladder base receives approximately 1 S. E. D. from each 4 mc. or 528 mc. hr.

At the time the earliest bladder injuries appeared there was speculation as to which type of uterine treatment was responsible. From the figures shown above, it is evident that the radium applicators and gold seeds produce the greatest bladder changes and the roentgen rays are of less importance. Generally speaking, for each 1,000 mc. hr. delivered to the cervical canal or uterine cavity by any of the usual radon applicators the bladder wall receives 1 S. E. D. If gold seeds are used, the bladder receives 1 S. E. D. from each 500 mc. hr.

There was wide variation in the amount of radiation given the patients in this series. The smallest dose was 1284 mc. hr. administered in the form of a fibroid tandem for fibromyoma uteri. From this treatment the bladder received a trifle less than  $1\frac{1}{2}$  S. E. D. The largest doses were given to four patients who were treated with several forms of radon applicators and the high voltage roentgen rays. In these cases the bladder received approximately 8 S. E. D.

In the irradiation of serious diseases, especially radioresistant cancer, comparatively heavy doses must be given. Peculiarities of the individual case sometimes require that the treatment be repeated or that an unusually large proportion of the dose be in the form of gold seeds. It is natural that a higher percentage of these patients should develop bladder complica-

tions. On the other hand, occasionally a woman receives relatively light irradiation for a comparatively insignificant disease and subsequently presents painful bladder symptoms. These cases give the gynecologist much embarrassment. The writer, who was not present when these patients were treated, finds it impossible to explain such an occurrence. Even the operators, who have frankly gone over each step in their technique, have been at a loss for an adequate explanation.

It would be of interest to know whether bladder injuries are more frequent after the treatment of advanced or early primary cervical cancers. A clue as to the cause of the injury might be obtained because the advanced tumor is bulky and infected, while the early growth is smaller and less infected. Unfortunately our data are too scant.

#### PATHOLOGY

There are three well recognized radiation reactions. They will be described as they appear on the skin. Within about twenty-four hours of a therapeutic dose there is a blush or erythema. This is probably a reaction to irritation such as follows the application of a mild mustard plaster. It is not a specific radiation effect.

At the end of about a month, if an average dose has been given, an erythema appears which gradually turns tan and then brown. Slight itching may accompany the erythema. This is a specific radiation effect and is called the secondary erythema. It is thought to be caused by a temporary, localized vasomotor paralysis. If an unusually strong dose of radiation has been applied, the secondary erythema will appear sooner and may progress to tissue destruction. In this series four patients suffered painful bladder symptoms at the time the secondary reaction was due. Inspection of these bladders showed conditions ranging from moderate congestion to acute inflammation with fibrinous exudate. No ulceration was present. The reactions were limited to the posterior bladder base. Three of these patients later developed other radiation injuries of the bladder, the fourth has not as yet.

The most important destructive effect of therapeutic doses of radiation is the tertiary radiation reaction. It was formerly called a delayed radium burn. Like the secondary erythema, it is a specific radiation change. The lesion is the result of obliterative endarteritis and requires a considerable amount of time for its production. The bladder injuries considered in this paper are manifestations of this condition.

It is rare for the tertiary radiation reaction to appear earlier than a year after treatment. It may not reveal itself for more than twelve years. The earliest appearance in this series was ten months, the latest was 114 months, or nine years, six months. The average time of appearance in 46 patients was thirty months, or two years, six months after irradiation.

The condition within the bladder closely resembles that seen on the skin. There may be a white, avascular central area surrounded by a zone of dilated blood vessels. If the center breaks down an ulcer is formed.

Whether the frequent movements of the bladder are conducive to ulceration it is difficult to state. At any rate definite ulcers were found in the bladders of 71 per cent of the patients of this series. In conjunction with ulceration in the bladder there was always infection. Practically all of the ulcers were covered with calcareous deposits. Histologic examination showed granulation tissue and various degrees of inflammation. In general, the microscopic picture was that of chronic cystitis.

#### SYMPTOMATOLOGY

The onset of symptoms usually is sudden with no premonitory sensations. Practically all of these women were performing their accustomed duties when bladder distress began. The initial symptom was frequency in 70 per cent of the cases, hematuria in 18 per cent, and dysuria in 12 per cent. To the first symptom was almost immediately added one or both of the other symptoms. At some time dysuria was present in 87 per cent of the cases, frequency in 82 per cent, and hematuria in 45 per cent. The usual train of symptoms was a sudden attack of urinary frequency accompanied or soon followed by dysuria, with hematuria observed by about half of the patients.

The women suffer acutely. Urination may occur every few minutes, although it is more likely to be at the rate of every hour or two both day and night. Dysuria may be intense. It is usually described as burning in character, and terminal. Hematuria varies from a faint red urine to sudden, uncontrollable hemorrhage with a fatal outcome. We do not know of a case of serious hemorrhage occurring as an initial symptom, but two of our patients while under treatment bled to death in their homes before help could arrive while a third was barely saved by an emergency operation and three blood transfusions.

#### DIAGNOSIS

It is essential to make the correct diagnosis because inappropriate treatment will be followed by disastrous results. Diagnosis is comparatively easy if the possibility of the condition is kept in mind.

In most cases many months have elapsed since the attention of the patient has been directed to her pelvic organs. Since the new symptoms are so obviously from a different source, the bladder, the patient almost never associates her former treatment with her present illness. As a result she rarely volunteers information concerning previous irradiation. Nor does the skin of the lower abdomen preserve its pigmentation for so long a time and thus furnish a clue. When any woman complains of urinary frequency, dysuria, or hematuria, she must be asked specifically if she has ever been treated with irradiation for any disease of the uterus. If answered in the affirmative, the examiner should suspect a radiation injury of the bladder. Not infrequently bladder symptoms appear while the patient is under the care of the gynecologist who treated her for uterine cancer. Naturally he is fearful of a direct extension of that disease to the



bladder, and since such a condition may be similar in appearance to radiation injury, an incorrect diagnosis may be made.

The cystoscopic picture of a radiation injury of the bladder frequently is indistinguishable from either primary or secondary cancer. With patients of the cancer age presenting the symptoms of frequency, dysuria, and hematuria, the similarity is complete.

A careful vaginal examination should be performed first. With radiation injury palpable induration of the bladder base is rare. This is important because even when one finds an extensive ulcerating lesion of the bladder base simulating newgrowth, one may be almost certain, if palpable induration is lacking, that one is dealing with radiation injury rather than bladder carcinoma.

In these cases passage of the cystoscope is not excessively painful without anesthesia. The urine is more or less cloudy with pus. Mucous and small blood clots in an amber urine are frequent findings, or the specimen may be frankly discolored with blood. The reaction of the urine is almost always alkaline. The bladder capacity varies with the size of the ulcer and the amount of infection present. A radiation ulcer is always located in the posterior third of the bladder base, and almost always in the midline. Unusually large ulcers have been seen extending upward on the posterior wall, but I have never found involvement of the trigone, anterior wall, lateral walls, or vault. The ulcers are single, circular or rounded, and vary in size from 5 mm. to 5 cm. in diameter. The surface is covered with white or light gray slough. Usually this is impregnated with calcareous deposits. Before healing begins the slough separates from the ulcer with difficulty and leaves a bleeding surface. Surrounding the ulcer there is a red zone of intense inflammation. Not infrequently bullous edema is present. This may be mistaken for papillary carcinoma.

Four per cent of our patients showed no ulcer but in the posterior third of the bladder base there was acute inflammation with deep red spots of punctate hemorrhage.

Twenty-five per cent of the patients showed a round, white area in the posterior bladder base. This usually was about 1 cm. in diameter. It marked the center of a reddened area of varying size. In these cases there was no visible break in the surface of the mucous membrane. These patients never had hematuria. In several cases the central avascular portion subsequently broke down to form an ulcer. When this occurred hematuria was noted.

In all cases a biopsy should be performed. A cystoscope rougeur is satisfactory for this purpose. The specimen is removed from beneath the slough, or, if no ulcer is present, it is taken from the congested zone surrounding the white center. Sometimes the picture resembles carcinoma so closely that several pieces of tissue are necessary for histologic study. No woman with ulceration of the bladder base who previously had received irradiation for uterine disease should be treated for bladder cancer until the diagnosis has been established by microscopic study.

## PROGNOSIS, COMPLICATIONS AND SEQUELAE

In general the prognosis for ultimate recovery is good. If the lesion has not reached the ulcerative stage, symptoms may be relieved in two weeks. They may disappear within a month. When ulceration is extensive prognosis must be guarded. In these cases regular treatment must be continued for many months. A vesicovaginal fistula may form. Sudden hemorrhage may cause death. The patient may become a morphine addict in her attempt to escape intense pain. Suffering may lower the woman's resistance and intercurrent disease may prove fatal. No ascending renal infections have been found in spite of marked cystitis and bladder tenesmus. Probably this can be explained by the fact that obstruction is not present at the bladder outlet. After the lesion has healed, recovery seems to be complete. Cystoscopic examination shows telangiectasis occupying the site of the former ulcer and the zone of inflammation. No permanent ill-effects have been noted as yet and no secondary breaking down has been seen.

Prognosis is especially grave when it has been necessary to give additional irradiation after a radiation injury has appeared. In these cases bladder damage progressed rapidly to a serious degree.

## PROPHYLAXIS

The problem of curing the uterine disease is of paramount importance, but it should be accomplished with the smallest amount of irradiation. The bladder should be protected by packing or some other type of shielding. In recent years the dose of radiation for uterine tumors has been diminished at the Memorial Hospital and the end results have been just as good. Formerly uterine irradiation furnished 7-8 S. E. D. to the bladder, at present the average is about 5 S. E. D. Even with this reduction there probably will be a certain number of bladder injuries because 57 per cent of the bladders of this series received 5 S. E. D. or less.

Infection is another factor of importance in the production of complications after irradiation. How large a part it plays in the bladder when irradiation is used in the uterus is not well known. At any rate, no measure for promoting asepsis should be overlooked.

## TREATMENT

The management of this distressing condition should be based upon perseverance in the face of many discouragements. In some cases treatment extends over many months with the patient in constant pain. Under such circumstances every supportive measure, even blood transfusions, must be utilized to maintain the woman's strength and morale. In general, treatment is symptomatic. The principal indications are to relieve pain and overcome infection within the bladder.

Pain can be relieved in most cases with Tr. Hyoscyamus, 4 c.c. in water every four hours. If this is unsuccessful, codeine is given by mouth. Whenever possible morphine should be avoided. Alkalies such as sodium

or potassium citrate are helpful and are prescribed in all cases in which there is no ulceration. With ulcers and slough, phosphatic deposits grow rapidly in alkaline urine. Heat is soothing whether furnished by electric pads or sitz baths. Exercise must be curtailed. In more aggravated cases, the patient must be kept in bed.

Although a number of remedies have been used to overcome infection, none have been satisfactory. We have not been encouraged by the use of any urinary antiseptics administered by mouth. It is helpful if the patient will maintain a high fluid intake, but sensitive bladders are intolerant. The urine should be made acid and this is difficult when phosphatic incrustations cover extensive ulcers. Perhaps we have had the greatest success with dilute phosphoric acid, 2-4 c.c. in water after each meal.

Lavage and instillations of the bladder have been the most valuable measures in our experience. For lavage, 1-2 per cent of phosphoric acid or one part of hydrogen peroxide in three parts of boric acid may be used. Lavage is followed, in the more acute cases with an instillation of 15 c.c. 10 per cent argyrol. As the patient becomes more tolerant, the strength of the phosphoric acid may be increased to 5 per cent, and instillations of 15 c.c. of 2 per cent mereurochrome No. 220 may be substituted for the argyrol. The best results are obtained from daily treatments. Ambulatory patients in clinics receive two or three treatments a week.

If the calcareous deposits are removed mechanically great gentleness is required. The cystoscopic rongeur or forceps are satisfactory for this purpose. Serious hemorrhage may be started if slough is removed before a certain amount of healing has taken place. If slough separates en masse it may obstruct the urethra. This gives rise to characteristic symptoms easily relieved by the cystoscope and forceps.

Treatment should be continued without interruption until healing is complete. Then the urine should be kept faintly acid and the patient should report for a follow-up examination every few months.

#### SUMMARY

Forty-seven women have been examined and treated for injuries of the bladder after irradiation of the uterus. Both radium and the roentgen rays had been used, although the more intense irradiation was delivered by radium. The primary uterine diseases comprised a number of conditions, both benign and malignant. The radiation therapy varied within wide limits, but in each case it was administered by an experienced gynecologist. Irradiation of the uterus preceded the onset of bladder symptoms in the average case by two and one-half years. The onset was sudden and often suffering was intense. Bladder symptoms consisted of frequency, dysuria, and hematuria. In some cases there was extensive tissue destruction and even death. Cystoscopic examination showed ulceration, anemic areas surrounded by intense inflammation, or punctate hemorrhage. The lesion was situated in the posterior third of the bladder base in or near the mid-line. Diagnosis was based upon the history, vaginal

examination, the cystoscopic picture, and a biopsy. Treatment consisted of Tr. Hyoseyamus and codeine for pain, dilute phosphoric acid both by mouth and for bladder lavage, and instillations of argyrol and mercuriochrome No. 220 (soluble).

#### CONCLUSIONS

1. Irradiation of the uterus occasionally is followed by injury of the bladder in spite of the most careful technic.
2. Symptoms of bladder injury are frequency, dysuria, and hematuria. They usually begin many months after the uterine irradiation has been given.
3. A woman of the cancer age who suffers with frequency, dysuria, and hematuria and who presents to cystoscopic examination an ulcerated condition of the bladder, may have either bladder cancer or a tertiary radiation reaction.
4. One must not be misled into making an incorrect diagnosis, because if a radiation injury of the bladder is treated by radiation methods, as for cancer, the results are disastrous.
5. Pain and infection often require resourceful treatment for many months.
6. With careful management the end results are excellent in the majority of cases.

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30 EAST FORTIETH STREET.

#### ABSTRACT OF DISCUSSION

DR. GEORGE G. WARD.—We have not paid enough attention to the complications of radium therapy. All who have used radium in carcinoma of the cervix particularly, and in the uterus and associated organs, have encountered similar experiences.

A point brought out which is well worth emphasizing, is that we should not be in a hurry to make a diagnosis of extension of cancer to the bladder when evidences of ulceration and slough are present following radiation. I can recall several cases in which the urologist stated that there was extension of cancer, but still the patients are alive and perfectly well today. I have one patient in mind that is well about nine years now. There was most extensive ulceration of the bladder with phosphatic deposits which cleared up entirely and the patient is perfectly well today.

I would like to call attention to another point of interest in regard to injuries of the bladder following radiation: In some 558 cases of carcinoma of the cervix that I studied recently there were 40 in which supravaginal hysterectomy had been done for fibroids or some other condition prior to the development of cancer in the stump of the cervix. It was of interest to find that these cases are much more susceptible to damage of the bladder when radium is placed in the vaginal vault and cervix than in the ordinary case. After supravaginal hysterectomy, the bladder practically rests on top of the stump of the cervix, and when the tube of radium is placed in the cervical canal, the radium is very close to the bladder. We found that injury to the bladder occurred two and a half times more frequently in this series of cases than it did in the others.

For a long period of time we have used an indwelling catheter to keep the bladder collapsed during the application of radium. We pack the vagina firmly to push the

bladder and rectum as far away as possible out of reach of the rays, and then the indwelling catheter keeps the bladder collapsed. We feel sure that we have less bladder irritability when this is done.

DR. H. R. CHARLTON.—I would like to say a word concerning the vital importance of the substance of this paper to men who are not particularly trained in or who have had little experience with the use of radium, and who are vulnerable to the persuasive advertising being carried on by various companies selling emanation. This has been brought closely to my mind in the Westchester Cancer Committee where scarcely a month goes by that my attention is not drawn to a request received at the cancer office to furnish radium. Upon investigation we find not infrequently that the man who has requisitioned radium has been led without previous experience to apply it through the advertising of companies who stress the simplicity of carrying out treatment but who give no warning of its devastating power.

It seems to me that the Memorial Hospital and other teaching clinics in which radiation is being carried on, have a tremendous opportunity and a very great responsibility in balancing this propaganda by bringing to the attention of men in practice the seriousness of ultimate results of treatments which they have been persuaded were altogether simple.

DR. WILLIAM P. HEALY.—We immediately refer each and every patient in the clinic who has dysuria or urinary frequency or any apparent new bladder symptom at once to the urologic clinic, and in this way we have been able to discover what seems like a reasonably large number of instances of bladder disturbance resulting probably from radiation, and yet in the sum total it is not a very large number when you consider the vast number of patients that we have treated there by radiation. If we treat cancer of the cervix with radiation therapy, we must be prepared to meet with bladder complications because we cannot hope to get sufficient effect of radiation into the cancer and into the immediately surrounding parametria without bringing about changes in nutrition at the bladder base.

Dr. Ward emphasized, and I agree with him, the value of the indwelling catheter in all cases in which radiation is used; whether it is a benign bleeding of the uterus where the dosage will be small, not over 700 or 800 or 1,000 mc. hours, or whether it is for carcinoma, it seems to me that the catheter is wisely used and yet, on the other hand, it is interesting to note that in Dr. Dean's study of these cases the lesion is always in the part of the bladder that is fixed and does not change its position at all.

The whole problem is so important that one must not use radiation because there is a bladder lesion, basing the radiation on the theory that there is cancer in the bladder, for metastatic or recurrent involvement of the bladder mucosa with carcinoma in a cured case of carcinoma of the cervix is extremely rare.

We would like to know why in a fibromyomatous uterus of fair size where we have used only a small dose of radiation, filtered in the usual way (one-half a millimeter of gold and two of rubber with two tubes and giving a dose as small as 1,200 mc. hours) the patient develops a year or two later a lesion in the bladder.

DR. HENRY D. FURNISS.—The radium effect on the bladder makes it more prone to infection, and in turn infection aggravates the condition and makes ulceration more likely.

I disagree with him on the subject of urinary antiseptics. I think that pyridium is of value, but that urotropin is very apt to aggravate ulcerative lesions produced by radium.

As Drs. Ward, Dean, and Healy have said, it is difficult sometimes from cystoscopic inspection alone to tell whether one is dealing with a recurrent carcinoma of the bladder or a radium lesion. I think one of the most valuable differential diagnostic points is the lack of induration which can be felt per vaginam when the lesion is in the bladder base; also if one has a recurrence or extension to the bladder, he will see some evidences of it in the region of the primary lesion.

# A CLINICAL STUDY OF AVERTIN IN GYNECOLOGY AND OBSTETRICS\*

GEORGE GORDON BEMIS, M.D., NEW YORK, N. Y.

(*From the Clinic of the Woman's Hospital*)

WITHIN recent years a number of new analgesic preparations have been introduced to the medical profession. Some of these after careful experimental and clinical studies have been found to be of great value; others after an initial wave of enthusiasm have fallen into disrepute, either because they failed to produce the desired effect or the margin of safety was too restricted to warrant their use.

Avertin is one of the new drugs widely advocated. It is chemically tribromomethyl alcohol and was first synthesized in Germany in 1923 by Willstatter and Duisberg.<sup>1</sup> Eiehholtz<sup>2</sup> subsequently investigated its anesthetic action in animals and man. In 1926 avertin was widely introduced into clinical practice in Germany by Butzengeiger.<sup>3</sup> At first large doses were given in an attempt to produce complete anesthesia with the result that a number of deaths directly attributed to it were reported. It was finally appreciated that doses sufficient to produce complete anesthesia were too dangerous and that the drug must in general be used only as an adjunct to an anesthetic. Recently Reuben Peterson and James Pierce<sup>4</sup> have reported favorably on the use of avertin in gynecology. As a result of observations in 300 consecutive cases they conclude that avertin more nearly approaches the ideal anesthetic than any other drug which has been employed.

During the past two years avertin has been used frequently at the Woman's Hospital. It is the purpose of this paper to report the clinical observations made in a series of 400 gynecologic patients, who were given avertin primarily as a basal anesthesia; and 75 obstetric patients, who had avertin during the latter stages of labor for the relief of pain.

## CHARACTER OF CASES INCLUDED IN GYNECOLOGIC GROUP

Practically all races were represented. The ages ranged from fifteen years to eighty-four years. Eighty-five and seven tenths per cent of the patients were normal, except for the gynecologic conditions bringing them to the hospital. The remaining 14.3 per cent had complicating medical conditions, as shown in Table I.

## TYPES OF OPERATIONS

All the usual gynecologic operations were performed in this group of patients. Two hundred and forty-four (61 per cent) had laparotomies; 117 (29.2 per cent) had vaginal operations; 26 (6.5 per cent) had combined

\*Read, by invitation, at a meeting of the New York Obstetrical Society, December 13, 1932.

TABLE I. COMPLICATING MEDICAL CONDITION

	NUMBER OF CASES
Anemia (secondary)	25
Syphilis	10
Uncomplicated hypertension	9
Hypertension and myocarditis	1
Hypertension and chronic valvular disease	1
Uncomplicated chronic valvular disease	1
Chronic myocarditis with auricular fibrillation	1
Pyelitis	3
Diabetes	2
Hypothyroidism	1
Chronic bronchitis	2
Arrested tuberculosis	1
Total	57

vaginal and abdominal operations; and 13 (3.3 per cent) were placed in a miscellaneous group, which included 10 radical mastectomies and 3 operations for hernia.

## ADMINISTRATION OF AVERTIN

About one-third of the surgical patients were given a sedative on the night before operation. One hour before the scheduled time of the operation a narcotic was administered. One hundred patients received a hypo-

TABLE II. TYPES OF OPERATIONS

	NUMBER OF OPERATIONS
<i>Laparotomies:</i>	
Hysterectomy	136
Salpingoophorectomy	33
Operation for retroversion	26
Myomectomy	21
Appendectomy	15
Separation of adhesions	6
Exploratory laparotomy	4
Sterilization, ligation of tubes	2
Operation for acute intestinal obstruction	1
<i>Vaginal Operations:</i>	
Plastic operations	75
Vaginal myomectomy	4
Vaginal hysterectomy	3
Watkin's interposition	1
Excision of vulva	2
Dilatation and curettage	24
Removal of Bartholin cyst	4
Repair of vesicovaginal fistula	1
Posterior colpotomy	1
Cystotomy	1
Hemorrhoidectomy	1
<i>Combined Laparotomy and Vaginal Operations:</i>	
Vaginal plastic and operation for retroversion	13
Vaginal plastic and hysterectomy	3
Vaginal plastic and appendectomy	3
Vaginal plastic and salpingoophorectomy	3
Vaginal plastic and ligation of tubes	3
Vaginal plastic and repair of ventral hernia	1
<i>Miscellaneous Group:</i>	
Radical mastectomies	10
Hernia	3
Total	400

dermic of morphine gr. 1/8 and atrophine gr. 1/200; and 300 a hypodermic known as H. M. C. No. 2. This preparation consists of morphine gr. 1/8, hyosine gr. 1/200, and cactoid gr. 1/120.

The avertin was given to the patient in her room one-half hour after the narcotic. It was administered as a retention enema in a 3 per cent solution of water at 40° C. To insure a satisfactory result the following precautions must be observed. A cleansing enema should be given six to twelve hours before the rectal instillation. The temperature must be exact. If heated much above 40° C., decomposition takes place, forming hydrobromic acid and dibromacetaldehyde which is extremely irritating to the intestine. It should be injected slowly as rapid administration may cause marked cyanosis and circulatory depression.

The dosage of avertin used in this series varied from 50 mg. to 100 mg. per kilogram of body weight and was dependent upon the condition of the patient. Anemia, cachexia, obesity, shock, hypertension, and a systolic blood pressure below 100 mm. of mercury were considered indications for smaller dosages of avertin.

#### GENERAL REACTION

Following the rectal injection, the patients gradually became drowsy and in many cases unconscious without any period of excitation or evidence of discomfort. It has been shown that avertin is absorbed rapidly from the rectum to the extent of about 80 per cent in the first twenty minutes. The time of onset of narcosis in this series varied from five to fifteen minutes and was dependent upon the dosage and the rapidity of administration. In the narcotized condition the patients were transported to the operating room. In every case there was complete amnesia, the patient recalling no event following the avertin until sometime after the operation.

#### EFFECTS ON THE CIRCULATORY SYSTEM

The action of avertin on the circulatory system has been carefully studied experimentally in animals by Raginsky, Bourne, and Bruger.<sup>5</sup> They have shown that concentrations of avertin in the circulatory system much higher than are found in the usual avertin anesthesia produce no deleterious effects upon the heart. They feel that avertin has a certain action on the peripheral circulation, but that this action is difficult to evaluate and appears to be of comparatively little importance.

In this group of patients a clinical study of the action of varying doses of avertin on the circulation was undertaken by an analysis of the changes in pulse rate, systolic blood pressure and diastolic blood pressure. The patients receiving morphine and atropine as a preliminary narcotic were studied independently from those given H. M. C. No. 2.

We have observed the kind of preliminary narcotic did not influence appreciably the action of avertin; and further that dosages of avertin varying from 50 to 100 mg. per kilogram of body weight had no constant effect upon the circulation.



Seventy-eight per cent of the cases showed an average increase in the pulse rate of 15 beats per minute, while the remainder had an average decrease of 8 beats per minute. The maximum increase was 52 beats per minute and the maximum decrease was 24.

Eighty-seven per cent had an average drop in systolic blood pressure of 22 mm. of mercury and the other cases had an average increase of systolic blood pressure of 12 mm. of mercury. The maximum drop was 84 points and the maximum increase was 27 points.

Two-thirds of the patients showed an average drop in the diastolic blood pressure of 16 mm. of mercury with a maximum of 42 mm. of mercury, while one-third had an average increase in the diastolic pressure of 10 mm. of mercury with a maximum of 36 mm. of mercury.

#### EFFECT ON THE RESPIRATORY SYSTEM

The action of avertin on the respiratory system was not constant. The amplitude of respirations was usually reduced but the respiratory rate might be slightly increased or decreased.

#### EFFECT ON THE KIDNEYS

The effect of avertin administration upon the kidneys has been carefully studied experimentally. Avertin is detoxified in the liver by combining as a coupled compound with glycuronic acid and is eliminated in this manner almost entirely by the kidneys. Veal, Phillips and Brooks<sup>6</sup> have found that while the coupled compound of avertin and glycuronic acid is promptly excreted by a normal kidney, it is not excreted by an injured kidney and that death results from the accumulation of avertin and the prolongation of its action.

In this series 17 per cent had a transient albuminuria on the day following operation and 2 per cent had albumin and casts. One patient had a temporary urinary suppression for twenty-four hours.

#### SUPPLEMENTARY ANESTHESIA

Nitrous oxide and oxygen, nitrous oxide oxygen and ether, or ether alone were the anesthetics used. In only 4.5 per cent of the patients was it possible to perform the operation without an anesthetic. Twenty-one per cent had nitrous oxide and oxygen; 71.5 per cent nitrous oxide oxygen and ether; and 3 per cent had straight ether. The amount of ether required was dependent more upon the duration of the operation than upon the initial dosage of avertin and varied from an average of 1.5 ounces in vaginal operations to 4.1 ounces in combined vaginal laparotomy cases.

#### COMPLICATIONS OCCURRING DURING THE ANESTHESIA ATTRIBUTED TO AVERTIN

An analysis reveals that 7.5 per cent had an unfavorable reaction during the anesthesia which could entirely or in part be attributed to the avertin. The reaction was either a depression of the circulatory or respiratory system or of both systems.

Age and dosage did not appear to be a definite factor in the reactions. The ages ranged from twenty-nine to sixty-nine years and the dosages in which reactions occurred varied from 60 mg. to 100 mg. per kilogram of body weight. Patients acutely toxic or in shock and frequently hypertension cases did not react well to avertin. The other medical complications encountered in this series had no apparent influence on the patient's reaction.

Patients in whom there was a marked circulatory depression were greatly improved by a subcutaneous injection of 1 c.c. of ephedrine. The respiratory depressions were treated by giving caffeine sodium benzoate gr. 7.5 and carbon dioxide.

TABLE III. POSTOPERATIVE COMPLICATIONS

	NUMBER OF CASES
Pyelitis	18
Pneumonia	4
Thrombophlebitis	4
Acute peritonitis	2
Suppression of urine (temporary)	1
Pleurisy	1
Postoperative psychosis	1
Embolism of pulmonary artery	1
Hemiplegia	1
Total	33

## POSTOPERATIVE COURSE AND COMPLICATIONS

The immediate postoperative course of the first six to twelve hours was characterized by fewer complaints than usual. The patients slept or were in a semiconscious state for a period of two to six hours. Their awakening

TABLE IV. MORTALITY

DIAGNOSIS	MG. OF AVERTIN	OPERATION	TIME OF DEATH	CAUSE OF DEATH
1. Acute peritonitis	100	Laparotomy	1 hr.	Acute peritonitis
2. Acute peritonitis	80	Posterior colpotomy	6 hr.	Acute peritonitis
3. Acute intestinal obstruction	60	Laparotomy	18 hr.	Intestinal obstruction
4. Carcinoma of ovaries	80	Hysterectomy Salpingo-oophorectomy	24 hr.	Thrombosis of inferior vena cava
5. Myoma uteri	80	Hysterectomy	3rd day	Acute peritonitis
6. Myoma uteri	70	Hysterectomy	10 hr.	Postoperative shock and hemorrhage
7. Carcinoma of breast	60	Radical mastectomy	7th day	Bronchopneumonia
8. Myoma uteri	80	Hysterectomy	12th day	Pulmonary embolism
9. Myoma uteri	80	Hysterectomy	3rd day	Peritonitis

approached more nearly that of a natural sleep. Fifty-two per cent had no vomiting or even nausea. In no instance did a patient complain of rectal irritation.

The following complications occurred; as shown in Table III.

#### MORTALITY

There were 9 deaths in the series of 400 cases. In no instance could the death be directly attributed to avertin.

In the first three cases it is quite probable that avertin hastened an inevitable death and in this sense might be considered a contributing cause. All three patients were acutely ill and very much depressed by an overwhelming toxemia and this depression was accentuated by the administration of avertin. It is apparent that avertin is not safe for patients in shock or depressed by sepsis or other toxic conditions.

#### AVERTIN IN OBSTETRICS

The ideal obstetric analgesia should fulfill the following requirements; it should be possible to administer without delaying the progress of labor; the patient should be relieved for a reasonable period of time; the drug must be fairly consistent in action and should have no undesirable effects upon either the mother or the baby; and the administration should not be too complicated.

There is a difference of opinion regarding the value of avertin in obstetrics. Ed. Martin<sup>7</sup> in a series of 4,500 cases reports that the procedure has none but the most salutary effects on mother and child. Schroeder<sup>8</sup> using the same method as Martin in a series of 110 cases reports that in 28 per cent the relief of pain was good, in 52.8 per cent it was fair, and in 10.9 per cent the method failed. He also states in 15 per cent delivery was delayed and in 22 cases atonic hemorrhage occurred. Weibel<sup>9</sup> feels that avertin is of value only during the expulsive period and that in the initial stages of labor other preparations should be used. Dodek<sup>10</sup> in a graphic study of the uterine contractions during labor following the administration of various analgesias came to the conclusion that avertin given by rectum in doses of 60 mg. per kilogram had no marked influence upon uterine contractions other than to prolong greatly the interval between them. He further states that after about forty-five minutes the uterine contractions resume their former frequency and painfulness.

#### CHARACTER OF CASES IN OBSTETRIC GROUP

The group of obstetric patients studied was composed of 75 normal women. Their ages ranged from seventeen to forty years. Forty-three were primiparas and 32 were multiparas. All had vertex presentations except two; one an undiagnosed brow, and the other an undiagnosed face presentation. Twelve of the vertex presentations were in an occipitoposterior position.

## CONDUCT OF LABOR

The use of avertin for relief of pain was limited in this series of cases to the latter part of the first stage of labor and to the second stage of labor. It was administered to the primiparous women when the cervix was effaced or almost fully so and the uterine contractions were at intervals of three to five minutes. The multiparous women, if progressing rapidly were given avertin when the cervix was dilated 6 to 7 cm. and if progressing slowly the avertin was withheld until fully dilated.

Until this degree of dilatation was obtained, the patients in the early stage of labor were partially relieved by a hypodermic which consisted of morphine gr. 1/6 to gr. 1/8 combined with scopolamine gr. 1/150 to gr. 1/200. The hypodermic was given 43 patients (57.3 per cent) after labor was definitely established; i. e., the contractions were moderately strong at intervals of three to five minutes, the cervix was dilated at least 3 cm. and the patient anxious for relief. In 3 cases it was necessary to repeat the hypodermic as labor had not progressed to the point where avertin could be administered. The remaining 32 patients (42.7 per cent) who did not receive a hypodermic, were either not particularly distressed or they were ready for avertin when they arrived in the hospital.

The dosage of avertin was 60 mg. to 70 mg. per kilogram of body weight and the method of administration was the same as in the surgical group.

## RESULTS

The patients following the administration of avertin became drowsy and very often fell asleep between pains. During this period which usually lasted thirty to forty minutes, the uterine contractions were generally weakened and the interval between them lengthened. After the initial stage of narcosis, labor gradually became more active and usually within an hour and a half to two hours the contractions were as frequent and painful as they were before the avertin.

Tables V and VI summarize the group as to the degree of relief of pain and the effect on progress of labor during this period; and also it contrasts the results obtained in patients who had a preliminary hypodermic of morphine and scopolamine with those who had only avertin.

In the morphine, scopolamine and avertin group of 43 patients, 6 patients (14 per cent) were completely relieved of pain; and of the 6 cases, labor was not influenced in 3 (7 per cent), was retarded in 2 (4.7 per cent), and was stopped in one (2.3 per cent). Thirty-three patients (76.7 per cent) of this same group were partially relieved of pain; in 9 of these cases (20.9 per cent) labor was not influenced, in 13 (30.2 per cent) labor was retarded, and in 11 (25.6 per cent) labor was stopped. There was no relief of pain and no interference with the progress of labor in 4 cases (9.3 per cent).

In the group of 32 patients who only had avertin, 5 (15.6 per cent) were completely relieved of pain, and of the 5 patients, labor was not influenced

TABLE V. RELIEF OF PAIN AND INFLUENCE OF DRUGS ON LABOR

	MORPHINE SCOPOLAMINE AND AVERTIN			
	PRIMIP.	MULTIP.	NO. TOTAL	PER CENT
<i>Complete Relief of Pain:</i>				
Labor not influenced	1	2	3	7
Labor retarded	1	1	2	4.7
Labor stopped	0	1	1	2.3
<i>Partial Relief of Pain:</i>				
Labor not influenced	7	2	9	20.9
Labor retarded	10	3	13	30.2
Labor stopped	10	1	11	25.6
<i>No Relief of Pain:</i>				
Labor not influenced	0	4	4	9.3
Labor retarded	0	0	0	
Labor stopped	0	0	0	
<i>Number of Cases</i>	29	14	43	100.0

TABLE VI. RELIEF OF PAIN AND INFLUENCE OF DRUGS ON LABOR

	AVERTIN			
	PRIMIP.	MULTIP.	NO. TOTAL	PER CENT
<i>Complete Relief of Pain:</i>				
Labor not influenced	0	3	3	9.4
Labor retarded	1	1	2	6.2
Labor stopped	0	0	0	
<i>Partial Relief of Pain:</i>				
Labor not influenced	7	6	13	40.6
Labor retarded	4	4	8	25.0
Labor stopped	2	1	3	9.4
<i>No Relief of Pain:</i>				
Labor not influenced	0	3	3	9.4
Labor retarded	0	0	0	
Labor stopped	0	0	0	
<i>Number of Cases</i>	14	18	32	100.0

in 3 (9.4 per cent), was retarded in 2 (6.2 per cent), and was not stopped in any case. In this same avertin group, 24 patients (65 per cent) were partially relieved of pain and in these cases labor was not influenced in 13 (40.6 per cent), was retarded in 8 (25 per cent), and stopped in 3 (9.4 per cent). There were 3 patients (9.4 per cent) who had no relief of pain following avertin but continued to progress normally with their labor.

From a comparative study of the group who had morphine, scopolamine and avertin (Table V) with the group who had only avertin (Table VI), it appears that morphine and scopolamine in combination with avertin,

while insuring more certain relief from discomfort, results in a slightly greater tendency to delay the normal progress of labor.

There was complete amnesia after the avertin in 29 per cent of the cases, partial amnesia in 62 per cent, and no amnesia in 9 per cent.

Nineteen patients had normal deliveries. Forty-one were delivered by low forceps. The indication was given in 34 of these cases as prophylactic, in 4 cases as extreme restlessness and lack of cooperation following the avertin; and in 3 cases uterine inertia as a result of avertin administration. Seven patients were delivered by mid-forceps; in 4 the indication was a slight disproportion, in 2 restlessness after avertin, and in one uterine inertia following avertin. Eight patients were delivered by a Scanzoni rotation and medium forceps because of a persistent occipitoposterior position.

Sixty-two babies were born without any signs of asphyxia, 11 babies were slightly asphyxiated at birth; but did not require resuscitation. The cause of this slight asphyxia was undetermined in 4, all low forcep deliveries; possibly avertin in 3, one a normal delivery and the other two low forcep deliveries; a difficult delivery was considered the cause in 3 other cases; inhalation of mucus in one; tight cord around the neck in one; and difficulty in extracting the shoulders in another case. The 2 cases where the asphyxia was more marked and required resuscitation were both instrumental cases; one a Scanzoni rotation and mid-forceps delivery, and the other case was a low forceps delivery.

Seventy-two mothers were in good condition and 3 mothers were considered in poor condition immediately following delivery. Two of the latter patients developed symptoms of shock, in one case it was attributed to fatigue following a prolonged labor of thirty-nine hours and a mid-forceps delivery; in the second case one of pronounced hydramnios, it followed immediately after rupture of the membranes and delivery. In the third case avertin was considered probably a contributing factor. This patient had an uneventful first and second stage of labor. Following delivery the uterus remained relaxed and the patient lost about 750 c.c. of blood. All 3 cases reacted promptly following a gum glucose infusion.

There was no maternal death nor was there any stillbirth.

#### UNDESIRABLE REACTIONS ATTRIBUTED TO AVERTIN IN THE OBSTETRIC GROUP

Lack of cooperation and difficulty in managing the patients during the uterine contractions frequently followed the administration of avertin. There was a tendency to grasp the external genitalia when in pain. Extreme restlessness was a troublesome factor in 9.3 per cent of the cases.

Atony of the uterus occurred in 9 cases (12 per cent). Eight patients had bleeding varying from slightly more than normal to a hemorrhage of 500 c.c. One patient had a hemorrhage of 750 c.c. This tendency to relaxation when it occurred lasted for a period of one to three hours and required constant watching during this time.

## CONCLUSIONS

1. Avertin can be safely and advantageously used as a basal anesthetic in selected surgical cases.
2. The effect on the circulatory and respiratory systems is inconstant.
3. The unfavorable reactions noted in this series were depressions of the circulatory and respiratory systems. The apparent predisposing factors for these depressing effects were shock, profound toxemia, and hypertension.
4. Complete amnesia, absence of the immediate preoperative emotional agitation, lessening of the amount of ether required for anesthesia, and a more comfortable postoperative convalescence are reasons for advocating the use of avertin in gynecology.
5. There were no deaths directly attributed to avertin, but in 3 patients who were acutely toxic; two from sepsis and one from an acute intestinal obstruction it probably hastened death by its depressing effects on these patients.
6. The usefulness of avertin in obstetrics during labor is limited greatly by its frequent failure to satisfactorily relieve the patient of pain and at the same time allow labor to progress. Its use is further restricted by the relatively short duration of satisfactory action.
7. Obstetric patients under the influence of avertin frequently become extremely restless, uncooperative, and difficult to manage.
8. Postpartum atony of the uterus with abnormal blood loss is not an unusual complication.
9. Avertin apparently has no unfavorable effects upon the baby.

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121 EAST 60 STREET.

## ABSTRACT OF DISCUSSION

DR. GEORGE G. COCHRAN.—I reported recently a series of 150 similar cases from the Brooklyn Hospital, and it might be of interest to compare results.

The routine generally followed was morphine and scopolamine hypodermically until the cervix had become effaced and dilatation had progressed to about one inch. At this time a 60 mg. per kilogram dose of avertin was given by rectum and when indicated, a second or third dose at three-hour intervals.

In our series five-sixths of the patients were primiparas and no prolongation of labor was noted. The method of delivery was cesarean section 3; high forceps 1; low forceps 12; forceps control and perineotomy 101; spontaneous vertex 26; spontaneous breech 3; breech extraction 4. With this high incidence of forceps control, it is rather hard to judge the duration of the second stage. We are of the impression that in a number of cases there was a definite retardation of the progress of labor in the second stage.

There were 4 stillbirths, none attributed to avertin. Also 6 of the babies required resuscitation. There were no maternal deaths.

Our results were tabulated after the method of the Boston Lying-in Hospital. Of the 32 patients receiving two doses of avertin 5 remembered clearly; 15 remembered vaguely; and 17 remembered nothing concerning their labor. Two patients receiving three doses remembered vaguely. One hundred and one patients received one dose. Twenty of these remembered clearly; 65 remembered nothing; and 30 vaguely remembered their experiences. Of the 25 who remembered clearly 20 said they had a hard time; the other 5 said they had an easy time, and that they had received considerable relief from the medication.

I feel that avertin produces a successful state of analgesia or amnesia, but in many cases more nursing care was needed than with some of the other agents such as the Gwathmey ether-in-oil routine.

In cesarean section operations we feel that avertin used purely as a basal anesthetic has the advantage of relieving the preoperative anxiety and lessening the postoperative discomforts.

DR. W. P. CONAWAY.—In the Atlantic City Hospital avertin anesthesia has been used in very few obstetric cases, less than six, I think, because it was not considered especially valuable, but in gynecology and general surgery up to Dec. 1, 1932, it has been used in about 536 cases. When we first began to use it, we did not consider it especially valuable on account of the prolonged narcosis. One patient slept for about twenty-two hours and required the constant presence of a nurse. Since using it as a basal anesthesia only, supplemented by gas-oxygen, but never ether, we have used it more routinely. On my service up to Dec. 1, 1932, we have used it in 125 major operations supplemented by gas-oxygen.

DR. F. C. HOLDEN.—I have used avertin in private work in the last three years rather extensively. It is very essential that the patient who has had avertin, have the exclusive services of a nurse until entirely out of the anesthetic, since the patient may "swallow her tongue" and if not closely watched, this might have a fatal outcome. It is a wise procedure not to remove the throat tube until the patient coughs it out.

## PELVIC SYMPATHECTOMY FOR PAIN IN CARCINOMA OF THE CERVIX\*

CHARLES AUGUSTUS BEHNEY, M.D., PHILADELPHIA, PA.

*(From the Department of Obstetrics and Gynecology, University of Pennsylvania)*

**I**NTERRUPTION of portions of the abdominal sympathetic system for the relief of pelvic pain, proposed and carried out by Jaubaulay in 1899, received little immediate recognition from the medical world. More than twenty years later a variety of operations upon the abdominal and pelvic autonomic nervous mechanism were developed in Europe, for the most part by French surgeons. So satisfactory were the results reported by these workers, that procedures of abdominal and pelvic sympathectomy were gradually adopted by operators on the continent and Australia. In the United States interest in abdominal sympathetic surgery has been less enthusiastic and the small amount of work done along these lines has been performed mainly by neurosurgeons who have applied it to a variety of

\*Read at a meeting of the Obstetrical Society of Philadelphia, November 3, 1932.



indications, mostly extrapelvic in nature, such as Raynaud's disease, Hirschsprung's disease, caudalgia, and intermittent claudication, in the lower extremities. A comparatively small number of patients with dysmenorrhea have been treated in this way by Grant, Adson, and others.

Fontaine and Hermann in their recent monograph on this subject, and others (Cotte, Leriche, and Bittmann), most enthusiastically recommend surgery of the pelvic sympathetic nerves, not only for so-called essential dysmenorrhea, but for other gynecologic conditions such as ovarian neuralgia, and the pain of advanced pelvic carcinoma. Curiously, this work has failed to impress American gynecologists, and we have been unable to

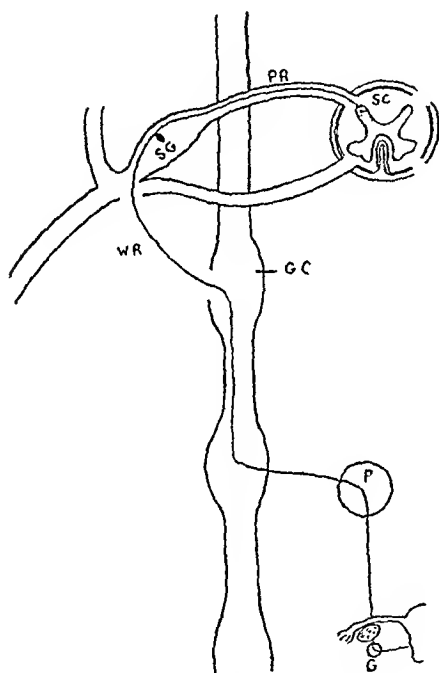


Fig. 1

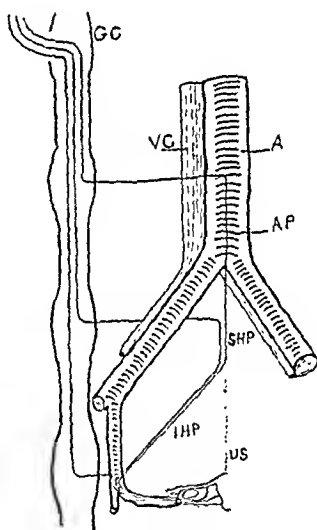


Fig. 2

Fig. 1.—Diagrammatic representation of the visceral-sensory fibers from the viscera to the spinal cord. *G.*, ganglion; *P.*, plexus; *G. C.*, ganglionated cord; *W. R.*, white ramus of spinal nerve; *S. G.*, spinal ganglion; *P. R.*, posterior root; *S. C.*, spinal cord.

Fig. 2.—Diagrammatic representation of pathways by which visceral sensation from the pelvic organs is transmitted. Majority of fibers pass through the superior hypogastric and aortic plexuses but some reach the ganglionated cord at various lower levels. *U. S.*, sympathetic nerve fibers in uterosacral ligaments; *I. H. P.*, inferior hypogastric plexus; *S. H. P.*, superior hypogastric plexus; *A. P.*, aortic plexus; *A.*, aorta; *V. C.*, vena cava; *G. C.*, ganglionated cord.

find reports of its application, in this country for the relief of pain in patients with hopeless pelvic malignant neoplasms.

Notwithstanding improvements in the administration of high voltage roentgen therapy, more scientific application of radium, relief of ureteral obstruction, et cetera, there are still patients with pelvic carcinoma whose suffering baffles all attempts at relief, short of the administration of enormous and increasing doses of narcotics. It seemed proper, therefore, to investigate any suggestion which offered reasonable promise of adding some degree of comfort to such women. With this purpose in mind, after a study

of the literature and examination of the regional anatomy on cadavers, abdominal sympathectomy was attempted upon seven patients, all with advanced carcinoma of the cervix.

### ANATOMY

The afferent visceral-sensory fibers from the uterus, the adnexa, and the rectum, pass to the inferior hypogastric plexuses, which are situated lateral to the vagina and rectum on the posterior fold of the broad ligaments. The inferior hypogastric plexuses unite at the level of the sacrum and become the superior hypogastric plexus. Some fibers from the uterus reach the superior hypogastric plexus through the uterosacral ligaments and some enter the ganglionated cord more directly by way of the sacral plexuses. The fibers of the superior hypogastric plexus pass upward, some to the aortic plexus which encircles the aorta, and others beneath the iliac arteries, to reach the lumbar ganglia of the sympathetic cord. All these fibers eventually reach the posterior roots of the spinal nerves, in whose ganglia are situated the neurones of which the afferent visceral sensory fibers are the dendrites. The visceral sensory impulses continue to the posterior horn of the spinal cord by way of the posterior root of the spinal nerves. The fibers pass without interruption from the viscus to the spinal cord.

The ganglionated cords, in the lumbar region, lie beneath the aorta on the left side and beneath the inferior vena cava on the right side and upon the lumbar vertebrae. They are mesial to the inner borders of the psoas muscles. The aortic plexus surrounds the aorta from the origin of the inferior mesenteric artery to the bifurcation into the common iliac arteries.

The superior hypogastric plexus (also named the presacral nerve of Laterjet and Rochet) consists usually (in 80 per cent of cases) of a very complicated network of nerve fibers. It is sometimes condensed into two distinct cords and occasionally is seen as a single large nerve trunk. Lying ventral to the sacral promontory upon the prevertebral fascia and immediately beneath the posterior parietal peritoneum, it is sometimes visible in emaciated subjects. Its fibers are continuous with those of the aortic plexus above, and at its lower end this plexus divides into the two inferior hypogastric (pelvic) plexuses. These fibers are closely associated with the adventitia of the internal iliac vessels and their branches.

The operations proposed for the relief of pain due to pelvic malignancy are: lumbar ganglionectomy, excision of the aortic plexus, excision of the superior hypogastric plexus (Hovelacque), and periarterial sympathectomy of the internal iliac arteries. Numerous surgeons, including Tisserand, and Grant, consider a combination of the latter two procedures the operations of choice, while other authorities, among whom are Fontaine and Hermann, advise the combined procedures of resection of the superior hypogastric and aortic plexuses and lumbar ganglionectomy. Cotte and Leriche have found extensive hypogastric plexus excision adequate.

### OPERATION

After the customary preparation for a laparotomy, with the patient in extreme Trendelenberg position, a mid-line incision is made from the symphysis to the umbilicus. The ileum is carefully packed into the upper abdomen and the sigmoid is drawn to the left, where it is held by a gauze sponge and a retractor. The superior hypogastric plexus is now approached by incising the posterior parietal peritoneum at the level of the sacral promontory. The incision is continued upward to the bifurcation

of the aorta and downward for a sufficient distance to expose the retroperitoneal tissues for 5 or 6 cm. The peritoneum can be separated from the underlying structures by blunt dissection until it has been elevated laterally as far as the common iliac arteries. This step exposes the superior hypogastric plexus, enveloped in fibrous tissue and fat, and in thin subjects the glistening components of the plexus may be readily seen. When obscured by subperitoneal fat, the nerve fibers must be teased out and isolated. The fibers are then easily raised from their bed by blunt dissection. Separation to the left of the mid-line, where the plexus will be found in close relationship with the left common iliac vein, must be done carefully and gently to avoid injury of this important vessel. After all, nerve fibers have been elevated for a distance of 6 cm. below the bifurcation of the aorta, a Pagenstecher ligature is placed about the plexus at this point and the nerve tissue is divided. All of the fibers situated between the iliac arteries and upon the prevertebral fascia are removed to the level of the bifurcation of the aorta.

Removal of the aortic plexus (periaortic sympathectomy) requires upward prolongation of the incision. It is performed by removing the plexus on the aorta, as far as the origin of the inferior mesenteric artery. Fibers overlying the inferior vena cava should also be teased away and divided. If at this point the inferior vena cava is gently retracted toward the mid-line, the ganglionated cord on the right will be seen lying mesial to the right psoas muscle. Similarly, by retracting the aorta mesially, the left ganglionated cord is exposed. A portion of each of these structures sufficient to include the third and fourth lumbar ganglia, should be resected.

The internal iliac arteries are located at the bifurcation of the common iliaes, and after incising the parietal peritoneum at this point, the artery is seen in close relationship with the corresponding ureter. The latter important structure is separated from the vessel by blunt dissection and retracted. The adventitia of the vessel with the sympathetic structures contained in its substance is then removed from the origin of the vessel for a distance of several centimeters.

Unless one of the more important vessels has been injured accidentally, there is rarely troublesome bleeding. The few small vessels to the plexuses, which must be divided in order to remove the nervous structures, are clamped and ligated with linen ligatures. When assured that satisfactory hemostasis has been secured, the peritoneal incisions are closed with continuous sutures of fine chronic catgut, and the operation is then concluded with the usual technique for any laparotomy.

Several operative procedures were used in this series for the purpose of comparison and for expediency. This report concerns seven patients upon whom pelvic sympathectomies were attempted. Only patients in extreme pain from stage four carcinoma of the cervix were selected and they have been followed up to the present time or for the duration of their lives. Complete and permanent relief of pain in the lower abdomen and thighs

from the time of operation was the criterion of success. Four of the seven patients were ambulatory and three were bed-fast before operation. Four of the group are dead. One died nine days after sympathectomy from uremia; the second, two and a half months after the operation, from the same cause. Two patients died at home, one from an uncontrollable diarrhea, two months after treatment, and the other from hemorrhage, four and a half months postoperatively. Three are still alive, three weeks, three and one-half months, and four and one-half months after sympathectomy, respectively. Since only very advanced patients were selected for this work, the relatively short duration of life in most instances is not surprising.

TABLE I

PATIENT	OPERATION	RESULT
B. G.	Resection superior hypogastric plexus	Relieved
A. DeG.	Resection superior hypogastric plexus	Failed
R. A.	Resection superior hypogastric plexus. Internal iliac peri-arterial sympathectomy	Relieved
K. S.	Sympathectomy impossible (Left iliac vein injured)	Failed
S. U.	Resection superior hypogastric plexus. Internal iliac peri-arterial sympathectomy	Relieved
M. L.	Resection superior hypogastric plexus. Internal iliac peri-arterial sympathectomy	Relieved
V. S.	Resection aortic and superior hypogastric plexuses (Inf. mes-enteric artery injured)	Relieved

All incisions healed by first intention and there were no postoperative complications. In spite of the extensive involvement of the bowel with metastatic carcinoma, the slight amount of distention and gas pains was a striking feature in the convalescence of each case. Frequent defecation for from four to eight days was noted in four patients. In two patients diarrhea accompanied the formation of rectovaginal fistulas and in one of these was apparently the cause of death. Incontinence of feces for two days, without a fistula, was noted in one instance. One woman was incontinent of urine on two occasions within the first forty-eight hours, a second once during the first forty-eight hours, and a third once during the first twenty-four hours after operation. Two patients required catheterization. Reddish-blue blotching of the extremities was noted in two of the five white women.

In two instances the operation failed. Excision of the superior hypogastric plexus was done for the first of these. The plexus in this instance was condensed into two large cords. The section evidently failed to include all afferent fibers.

The second failure was in a nullipara, aged twenty-three, who had widespread metastases with the omentum so densely adherent to the fundus of the uterus and the iliac arteries that exposure of the sympathetic plexuses was impossible. In this instance, there was not the slightest relief from

pain and the patient died in the hospital after ten weeks of almost continual narcotization. This mortality can hardly be attributed to the operation.

Of the operative procedures which have been proposed for the relief of pain from advanced pelvic carcinoma, sympathectomy has much to recommend it to pelvic surgeons. While a neurosurgical procedure, it is distinctly within the field of the gynecologist. Its performance affords all of the advantages of an exploratory laparotomy, permits the securing of tissue for histologic diagnosis and allows one to study the metastatic habits of the various types of malignant growths. Unless troublesome adhesions are encountered, sympathectomy is neither difficult nor time consuming. The incision is so situated that it produces no discomfort during convalescence, and its healing is not adversely influenced by the recumbent posture. There is no disturbance of cutaneous sensation or motor function in the lower extremity.

In our small series, despite the poor physical condition of most of our patients, the operation was borne surprisingly well. A mortality rate of even 14 per cent, should be reduced by earlier intervention and restriction of the field for such work to patients having a reasonable life expectancy. The indication for these procedures is pain which is not relieved by ordinary analgesics or x-ray therapy. Though our results are less than should be desired, we feel that operations of this type deserve further trial and hope that greater experience will enable us to apply them with more uniform success. Their fair evaluation requires observation of a larger series of cases.

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133 SOUTH THIRTY-SIXTH STREET.

#### ABSTRACT OF DISCUSSION

DR. OSCAR V. BATSON.—Surgical intervention for the relief of visceral pain may be effective in two ways. Relief may come from the sectioning of afferent, pain fibers or it may come from sectioning the efferent fibers to the blood vessels. The one method is palliative and the other is, in a measure, restorative. The sectioning of the pain fibers, which although accompanying the sympathetic fibers may not be sympathetic nerves, has obviously a wider clinical application.

When the pain is present due to a vascular disturbance, as in dysmenorrhea, a section of the nerves supplying the blood vessels is no doubt responsible for the relief. In pelvic carcinoma we may be dealing with pain due to vascular disturbances or, what is

more likely, with direct irritation of the pain fibers by the enlarged lymphatics. In this connection Franz Kiss pointed out the intimate intertwinings of the visceral sympathetic and lymphatic systems.

The presence of pain fibers in the sympathetic system is found elsewhere in the body, for example even with excellent nerve block anesthesia the dentist produces considerable pain in exposing the tooth pulp. This pain seems to be relieved by anesthetizing the sphenopalatine ganglion.

It is rather hard to conceive of all of these fibers going to the ganglion, as illustrated in Dr. Behney's charts. That brings me to mention that we do not know definitely the course of these pain fibers, and until that course is definitely plotted we may expect some irregularity in results.

I would like to ask Dr. Behney how many times this particular procedure has been employed in pelvic carcinoma.

In conclusion, I wish to repeat that sectioning of the sympathetic plexus may interrupt pain either by restoring a better vascularization of a part, or by cutting off fibers going into the central nervous system. The paper was a very interesting presentation of a field in which clinical practice is in advance of anatomical knowledge.

DR. BERNARD WIDMANN.—Of the four cases on whom Dr. Behney did pelvic sympathectomy, three showed 100 per cent relief of pain. Two of these patients I was able to follow for ten days and two weeks respectively. The third patient is still in the hospital and is under observation about one month. This case was readmitted to the hospital last July with a rectal-vaginal fistula and the pain was so excruciating that a quarter of morphine was routinely given morning, afternoon, and evening with only partial benefit. Today she no longer has any pain but is still getting a hypodermic at night largely because she is a partial addict. There is some pain about the knee joint regions, but this appears to be entirely arthritic in character.

It is interesting to note that in two of these patients, the pain was a deep-seated boring pelvic pain described by the patients as being "deep-down in the bladder."

Obviously some of these patients will not be benefitted by this type of treatment. I would, therefore, like to make a point of the character and distribution of pain which should be properly evaluated in each individual. Whether the pain be a so-called sciatic-like pain, low back pain, deep-seated pain in the hip joints, or pain reflected down the thighs to the knee joints, or a deep-seated pain in the pelvic fossa I think that if the character and distribution of the pain could be correlated with the end results of these operations that it is entirely possible that the future course of events will enable us to establish criteria that will materially aid in selecting the types of cases that should receive benefits from pelvic sympathectomy. It is well known that the pain may be an effect of necrotic tissue with an associated reaction to inflammation, or pressure from a progressive neoplastic infiltration or even pressure from enlarged iliac or aortic nodes or extension along the ureters but there may also be pain from actual bone invasion and particularly metastatic infiltrations of a perineural or perivascular character.

I feel that this form of treatment should receive further investigation along these lines and that the results obtained on three out of four cases in our department at the Radium Clinic of the Philadelphia General Hospital justifies the hope that this procedure should be effectual for certain characters and distribution of pain which may be predetermined by careful studies.

DR. BEHNEY (concluding).—In reply to Doctor Batson's question regarding the number of times sympathectomy has been done to relieve pain in advanced pelvic carcinoma, I have not found more than fifty cases in the literature which I have covered. These operations are not indicated in pain from ureteral obstruction, nor in metastasis, if irradiation is effectual.

## PSYCHOGENIC FACTORS IN FUNCTIONAL FEMALE DISORDERS\*

KAREN HORNEY, M.D., CHICAGO, ILL.

WITHIN the last thirty or forty years there has been much discussion in the gynecologic literature on the influence of the psychic factors in female disorders. The discrepancy of opinions is as wide as possible. On the one hand there is a tendency to let these factors shrink to a humble insignificance. These proponents will emphasize, for instance, that of course they see the emotional factors, but consider them dependent on constitutional, glandular and other bodily conditions.

On the other hand we see the tendency to ascribe to psychogenic factors a very great influence. The supporters of this point of view are inclined to see here the essential origin not only for more or less obvious functional disorders as pseudoeyesis, vaginismus, frigidity, menstruation disorders, hyperemesis, etc. But they also elaim a psychic influence for those diseases and disturbances which seem to be superior to suspiecion such as premature and postmature delivery, certain forms of metritis, sterility, some forms of leueorrhœa.

The fact that physieal changes can be brought about by psychic stimuli can no longer be doubted since Pavlov has put it on an empirical basis by his experiments. We know that by stimulating the appetite the secretion of the stomach can be affected, that the heart rhythm and the bowel movements can be accelerated under the influence of fear, that certain vasomotor changes, as for instance, blushing can be an expression of a shame reaction.

We have also a rather exact picture of the ways of transportation on which these stimuli are carried from the center nervous system to the peripheral organs.

It seems to be a wide jump from the statement of these rather simple connections to such a question as whether a dysmenorrhœa can be brought about by psychic conflicts. Yet I think there is not so much a fundamental difference in the process itself, but a fundamental difference in the methodologic approach. You can arrange an experimental situation where you stimulate the appetite of a person and where you can measure the secretion of the stomach glands. You can measure exactly the changes in secretion which take place when you produce some sort of fright reaction in the person, but you cannot arrange an experimental situation where a dysmenorrhœa is brought about. The emotional proceedings underlying a dysmenorrhœa are much too complicated to be possibly established in an experimental situation; but even if you could by experiment expose a

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person to certain very complicated emotional conditions, you could not expect any concrete results, because a dysmenorrhea is never the result of just one emotional conflict situation but always presupposes a series of emotional preconditions the foundation of which has been laid at different times.

For these reasons it is impossible to get on with these problems by way of experiment. A method which can reveal to us the connection between certain emotional forces and a symptom, as for instance dysmenorrhea must obviously be a historical one. It must enable us to understand the specific emotional structure of a person and the correlation of the emotions with the symptom out of a very detailed history of her life.

There is as far as I see only one psychologic school which offers such an insight with a rather high degree of scientific exactness; namely, psychoanalysis. In psychoanalysis you get a picture of the nature, the contents, and the dynamic strength of the psychic factors as they are effective in real life—a knowledge which is indispensable if one wants to discuss scientifically the question whether or not functional disorders can be brought about by emotional factors.

I shall not go into the details of the method here, but shall only present in a very concise form some contents of those emotional factors which in my analytical work I found essential for the understanding of functional female disorders.

I start with a fact which by its continuous repetition struck my attention. My women patients came to be analyzed for the most different psychical reasons: states of anxiety of all sorts, compulsion neuroses, depressions, inhibitions in work and in contact with people, character difficulties. As you will find in each neurosis their psychosexual life was disturbed. Their relation to men or to children or to both of them was in some way seriously hampered. What struck me was this: among these very different types of neuroses there was not one case without some functional disturbance of their genital system: frigidity in all degrees, vaginismus, all sorts of menstruation disorders, pruritus, pains and discharges which had no organic basis and which disappeared after uncovering certain unconscious conflicts, all sorts of hypochondriacal fears as fears of cancer or of not being normal, and some disturbances in pregnancy and childbirth which at least seemed suspicious of a psychogenic origin.

Here three questions arise:

1. This coincidence of a disturbed psychosexual life on the one hand and functional female disorders on the other may be very striking—but is this coincidence a regular one?

An analyst has the advantage of knowing some cases very thoroughly, but after all even a busy analyst sees only comparatively few cases. Therefore even if we find our results corroborated in other observations as well as in ethnological facts, this question about the frequency and the validity



of our findings is one for which the gynecologists should at some future date give an answer.

Of course, to do this, investigation would require from their side time and psychological training, but if only part of the energy which is put into laboratory work would be put into it, it surely would help to clarify the problem.

2. If we assume this coincidence exists regularly: could not both, the psychosexual disturbances and the functional ones, arise on the common basis of constitutional or glandular conditions?

I do not wish to go into a thorough discussion of these very complicated problems now, but only point out that according to my observations there is no regular coexistence of these bodily factors and emotional changes. There are, for instance, frigid women with distinct masculine attitudes and a strong aversion against the female rôle. Some of them have some physical masculine attributes—voice, hair, bones—most of them have, however, an absolutely female habitus. With both groups you could find out from what conflictful situations the emotional changes started—but only in the first group would it be doubtful whether the conflicts themselves might perhaps have arisen on a constitutional basis. I have the impression that as long as we do not know more about constitutional factors and their particular influence on later attitudes it is pseudoexactness to assume too strict a connection. Furthermore such an assumption may lead to very dangerous therapeutic consequences if one neglects the psychical factors. For instance, in the most modern German textbook of gynecology, Halban and Seitz, one author, Matthes, describes the following case: a girl came to ask his care for a dysmenorrhea which she had had for one and a half years. She told him that she had caught a cold on a dancing party. Later on he found out that she then had started a sexual relationship with a man. She told him that she was strongly sexually aroused by him but at the same time was enraged at him. As she represented what he calls an "intersexual type," he advised her to give up the man, acting on the motivation that the types of person to which she belongs never can be happy in a sexual relation. She tried to follow his advice and had two menstruations without pain. She then took up her love affair and the pains recurred.

This seems to be a rather radical therapeutic conclusion on the basis of very slight knowledge and reminds me of the saying in the Bible: "If thine eye offend thee, pluck it out."

From the therapeutic point of view it seems better to look on the psychic level for the conflicts which may have arisen perhaps from some constitutional factor particularly as we often see the same conflicts without the presence of such a factor.

3. It is the third question which I wish to discuss now. Its precise formulation would be, "Is there a specific correlation between certain

mental attitudes in psychosexual life and certain functional genital disturbances?" Unfortunately human nature is not so simple or our knowledge not far enough advanced as to enable us to make very clear and rigid statements. In fact you will find certain fundamental conflicts with all of these patients which correspond to the fact that you find some degrees of frigidity with all of them—at least a transitional one; but in a regular correlation with certain functional symptoms some specific emotions and factors play a predominant rôle.

With frigidity as the basic disturbance one finds invariably the following characteristic mental attitudes:

In the first place frigid women have a very ambivalent attitude towards men. There are always elements of suspicion, hostility and fear in it. Very seldom are these elements quite overt.

For instance, one patient had the conscious conviction that all men were criminals and ought to be killed. This conviction was the natural consequence of her conception of the sexual act which she thought was something bloody and painful. She considered every woman who married as a heroine. Generally you find this antagonism in a disguised form; and one can get insight into their real attitude towards men, not from their comments but from their behavior. Girls may tell you frankly how much they care for men, how they are inclined to idealize them, but at the same time you may see that they are likely to drop their "boy friends" very rudely without any apparent reason. To give a typical example from many similar ones: I had a patient X who had rather friendly sexual relations with men. These never lasted longer than about a year. Regularly after a short interval she felt increasingly irritated against the man until she could stand it no longer. She then sought and found some excuse to drop him. In fact her hostile impulses towards men became so strong that she was afraid to do them harm and avoided them. Or you may find women who tell you they feel devoted to their husbands but a deeper investigation will show you all those small but very disturbing signs of hostility which may come out in every day life, such as a fundamental depreciative attitude toward the husband, belittling his merits, withdrawing from his interests or his friends, making too great financial claims or waging a quiet but consistent fight for power.

You can in these cases not only get a more or less distinct impression that frigidity is a direct expression of undercurrent streams of hostility, but you can also in certain advanced phases of the analysis trace very accurately how the frigidity is initiated when a new source of inner aversion against men is revealed—and how it stops when they have overcome these conflicts.

Here is a marked difference in the psychology of men and of women. In the average case, sexuality in women is much more closely tied up with tenderness, with feelings, with affection than in men. An average man

will not be impotent even where he does not feel any particular tenderness for the woman. On the contrary there is very often a split between sex life and love life which means in the extreme pathologic case that he can only have sex relations with a woman whom he does not care for and that he has no sexual desires for and is even impotent towards a woman of whom he is really fond.

With women you will find, on the average, a closer unity between their sex feelings and their whole emotional life, probably for obvious biologic reasons. Therefore, a secret hostile attitude will express itself very easily in the inability of sexual giving and receiving.

This defense attitude against the man need not be very deeply rooted. In such cases a man who is able to awaken their tender feelings may be perfectly able to overcome the frigidity; but in another series of cases this attitude of hostile defense is very deep and the roots of it must be exposed if the woman is to be rid of it.

In this second series you will find that the antagonism against the man has been acquired in early childhood. To understand the far reaching consequences of early experiences in life it is not necessary to know much about analytical theory, but only to be clear on two points: that children are already born with sexual feelings and that they can feel very passionately, very likely much more so than we grown-ups with all our inhibitions.

You will find in the history of these women that there may be deeply engraved disappointments in their early love life: a father or brother to whom they felt tenderly attached and who disappointed them; or a brother who was preferred to them; or quite a different situation in this specific case: when the patient was eleven years old, she had seduced a younger brother. Some years later this brother died from the grippe. She had immense guilty feelings. Still after thirty years, when she came to be analyzed, she felt convinced that she had caused the brother's death. She believed that in consequence of her seduction her brother had started to masturbate and his death had been the consequence of his masturbation. This guilty feeling made her hate her own female rôle. She wanted to be a man, rather demonstratively envied men, let them down wherever she could, had fierce castration dreams and fantasies and was absolutely frigid.

This case, by the way, throws some light on the psychogenesis of vaginismus. She was not deflorated until four weeks after her marriage—and even then it was done by a surgeon, though no abnormality in her hymen existed and though the man was potent. The spasm was partly an expression of her strong aversion against the female rôle, partly a defense mechanism against her castration impulses toward the envied man.

This aversion against the female rôle often exerts a great influence however it may have started. In one case there was a younger brother who was preferred by both parents. The envy towards him poisoned her whole life and particularly her relations to men. She wanted to be a man her-

self and played this rôle in fantasies and dreams. During intercourse she sometimes had quite consciously the wish to change the sex rôles.

Now you will find in these frigid women another conflict situation often dynamically still more important: that is the conflict with the mother or with an older sister. Consciously the feeling toward the mother may be different. Sometimes they admit at the beginning—even to themselves—only the positive side of their relation. Possibly they have already felt struck by the observation that in spite of their craving for the mother's love, they have in fact always done just the contrary of what the mother would have liked them to do. In other cases there is an overt hatred. But even if they realize the existence of a conflict, they will know neither the essential reasons for it nor the influence it has on their psychosexual life. One of these essential features may be for instance that the mother keeps on representing for these women the agency which is forbidding sex life and sex pleasure. An ethnologist recently told the following custom of a primitive tribe which throws light on the ubiquity of these conflicts: when the father dies, the daughters remain in the house of the deceased, but the sons leave it, because they fear that his spirit might be hostile to them and do them harm. When the mother dies, the sons remain in the house, but the daughters leave it for fear that a spirit of the mother might kill them. The same antagonism and retaliation fear which has found here such a clear expression will regularly be seen in the analysis of frigid women.

Here one who does not know the process of analysis may ask: if these conflicts are not conscious to the patients, how can you pretend so definitely that they exist and that they play this particular rôle? There is an answer to this question which however may be difficult to understand for someone lacking the analytical experience. These older irrational attitudes are revived and reactivated towards the analyst. For instance, the patient X had consciously an affectionate attitude to me, though always intermingled with some fear; but at the time when her old infantile hatred against her mother came nearer to the surface, she trembled for fear in the waiting room and emotionally saw in me something like a ruthless evil spirit. From many detailed traits it became evident that in these situations she had transferred an old fear of the mother to me. One particular incident gave us the insight into the important part this fear of the forbidding mother played for her frigidity. At a period in the analysis when her sexual inhibitions had already diminished I was away for a fortnight. She told me afterwards that one evening she had been together with some friends and that she had drunk some alcohol but not more than she could ordinarily tolerate and that she had no memory of what happened afterwards. But her boy friend had told her that she had been very excited, herself asked for intercourse and that she had had a full orgasm—she was completely frigid until then—and that she had exclaimed several times in a sort of triumphant voice, "I have Horney holidays." The forbidding

mother rôle which I took in her fantasy was absent and therefore she could be a loving woman without fear.

Another patient with a vaginismus and a later frigidity had transferred to me the old fear she had towards the mother and particularly towards the sister eight years older. She made several attempts to make contacts with a man but always failed on account of her own complexes. Regularly in such situations she would feel infuriated against me and even sometimes express the rather paranoid fear that I had kept the man away from her. Though she realized intellectually that I was the one who wanted to help her to find adjustment, the old fear of the sister then had the upper hand. And at the time when she had had her first sexual experience with a man she promptly had an anxiety dream in which her sister chased her around.

There are in every case of frigidity other psychical factors involved, some of which I shall now mention. But I shall neglect the connection these have with frigidity and only point out the importance they may have for certain other functional disorders.

There is above all the influence which masturbation fears may exert on mental attitudes as well as on bodily processes.

It is well known that on the basis of such fears concerning masturbation nearly every disease may be regarded as a resultant from it. The particular form these fears often take with women is the fear that the genital organs are physically damaged by masturbation. This fear is often connected with a very fantastic idea that they once have been like a boy and have been castrated. Such a fear may express itself in different forms.

1. In a vague but deep fear of not being "normal."

2. In hypochondriacal fears and symptoms such as pains and discharges without an organic basis which drives them to seek gynecologic advice. They then will get a suggestive treatment or some sort of reassurance and will feel better—but naturally the fear starts again and they return with the same complaints. Sometimes this fear leads them to insist upon an operation. They have the feeling that something is physically wrong with them and can only by an operation be radically changed.

3. The fears may furthermore take this form: because I have damaged myself, I shall never be able to get a child. In very young girls this fear in this very connection may be sometimes quite conscious. But even these young patients usually will tell you first that they consider having children disgusting and never wish to have any. Only much later you hear this feeling of disgust represents for them a kind of "sour grapes" reaction against their very intense earlier wishes for having many children and that the above-mentioned fear has led them to deny this wish.

There may be many conflicting unconscious tendencies connected with the wish for a child. The natural maternal instinct may be counteracted by certain unconscious motives. I cannot go into details now and shall

only mention one possibility; for those women who in some part of their mind have an intense wish to be a man, pregnancy and motherhood as representing the equivalent female accomplishment has an enhanced significance.

I have unfortunately never seen a case of pseudocyesis, but probably it too results from unconscious reenforcement of the wish for a child.

Certainly a temporary amenorrhea will favor these wishes to have a child at any price. Every gynecologist knows women who are unusually nervous and depressed, but are perfectly happy and poised as long as they are pregnant. For them too pregnancy represents a particular form of satisfaction.

What is reenforced in the cases I have in mind is not so much the idea of having a child, nursing and caressing it, but the idea of pregnancy itself; of bearing the child in their body. The state of pregnancy has for them an exquisite narcissistic value. Two such cases had a postmature delivery. It is premature to draw any conclusions, but with all critical cautiousness one could at least think here of the possibility that the unconscious wish of keeping the child within might be an explanation for some cases of postmature delivery which are otherwise inexplicable.

Another factor which surely sometimes plays a rôle is an intense fear of dying at delivery. This fear itself may or may not be conscious. The real origin of the fear is never conscious. One essential element in it is, according to my experience, an old antagonism against the pregnant mother. One patient I have in mind who had an extreme fear of dying in childbirth remembered that she had as a child for many years anxiously watched her mother to see if she was pregnant again. She never could see a pregnant woman on the street without feeling the impulse to kick her against the womb and naturally had the retaliation fear that something equally awful would happen to her.

On the other hand the maternal instinct may be counteracted by unconscious hostile impulses against the child. Here very interesting problems are the possible influence of such impulses on hyperemesis, premature delivery and depressions after childbirth.

To go back once more to the masturbation fears, I have already mentioned that they might result in the idea of the patient being physically damaged and that this fear might lead to hyperchondriacal symptoms. There is another way in which these may be expressed: in the attitude towards menstruation. The idea of being damaged makes them resent their own genitals as a sort of wound and menstruation is emotionally conceived as a corroboration of this assumption. They have kept a close association between bleeding and a wound. It is understandable from this that for these women, menstruation can never be a natural process, but that they will have a deep disgust reaction against it. This leads me to the problem of menorrhagia and dysmenorrhea. Of course, I am only speak-

ing of those forms in which there is neither any local nor other organic cause. The basis for an understanding of any functional menstrual disorder is this: the psychical equivalent of the bodily processes in the genital organs at that time is increased libidinal tension. A woman who is very poised in her psychosexual development will meet this without any particular difficulties. But there are many women who just succeed in maintaining some sort of balance and for whom this increased libidinal tension is the straw which breaks the camel's back.

Under the pressure of this tension all sorts of infantile fantasies will be revived; particularly those which have some connection with the process of bleeding. These fantasies have, generally speaking, the content that the sex act is something cruel, bloody, and painful. I found without any exception that fantasies of this kind played a determining rôle in all patients with menorrhagia and dysmenorrhea. The dysmenorrhea usually starts if not in puberty at the time when the patient comes in contact with adult sex problems.

I shall try to give some examples: one patient of mine who suffered from a profuse menorrhagia always when thinking of intercourse had a vision of blood. One line which led up to it had to do with certain childhood memories.

She was the oldest of eight children and her most frightening memories concerned the time when a new child was born. She then had heard the mother scream and had seen bowls of blood carried out of her mother's room. The early association between childbirth, sex, and blood was so close for her that one night when the mother had a lung hemorrhage, she immediately connected it with the marital relations of her parents.

Her menstruation revived for her these old infantile impressions and fantasies of a very bloody sex life.

The patient whom I have already mentioned had a severe dysmenorrhea. She herself was perfectly aware that her real sex life had to do with all sorts of sadistic fantasies. Whenever she heard or read of cruelties, she felt sexually aroused. She described the pains which she had at the menstruation time as if her insides were torn out. This specific form was determined by infantile fantasies. She remembered having had as a small girl the idea that in intercourse the man tore out something from the body of the woman. In the dysmenorrhea she emotionally acted out these old fantasies.

I suppose that a great many of my statements concerning the psychogenic factors may sound utterly fantastic, though perhaps all this is not really fantastic but only foreign to our usual medical thinking. If one wishes to have more than a mere emotional judgment, there is only one way scientifically valid: a testing of the facts. The fact that we can cure these symptoms by uncovering their specific psychical roots is no scientific proof. Any skillful suggestion may eventually have the same result.

The scientific way of testing ought to be the same here as in other fields of science: to apply the same method, the psychoanalytical technic of free association, and see if the findings are similar. Every judgment which has not met this requirement lacks scientific value.

Yet it seems to me that there is still another way for the gynecologist to get at least a feeling of evidence for the specific correlation of certain emotional factors and certain functional disturbances. If only some time and attention would be given to the patients, at least some of them would reveal their conflicts very easily. I think this way of proceeding might even have some direct therapeutic value. A correct analysis can only be done by a physician who has had an adequate psychoanalytic training. It is a procedure not less incisive than an operation. Yet there is not only a major but also a minor surgery. A minor psychotherapy would consist in dealing with the more recent conflicts and uncovering their connection with the symptoms. The work which is already being done in this way could easily be very greatly extended.

There is only one limitation to such a possibility which one has to realize: one must have a rather thorough psychologic knowledge if one wishes to avoid mistakes; particularly those which may stir up emotions with which one is not able to cope.

#### DISCUSSION

DR. A. G. GABRIELIANZ.—The paper was timely. The gynecologist besides inserting his two fingers into the vagina must very delicately insert his two fingers also into the soul of the women. Constitutional pathology exists and interrelation between woman's disorders and her constitution is marked in many cases. This interrelationship as well as the correct secretion of her internal glands has a great influence on the psyche of women. The hypersecretion of corpus luteum leads women to neuropsychical weakness. Some cases are so striking that they may require consultation with psychiatrists. Hyperovarianism increases the individuality of women, makes them more impressive; they become talented, voluptuous and some practice masturbation. Hypoovarianism leads to psychic and somatic slothfulness and frigidity. In the biologic test there is absence of anterior pituitary and ovarian sex hormone in the blood and in the urine.

DR. WILLIAM H. RUBOVITS.—One statement which Dr. Horney made should be emphasized before a body of gynecologists. Namely, that "of course there are exceptions." I think, viewing the subject dispassionately, one must evaluate the opinions of the psychoanalysts who believe that many of the activities of the human body, more particularly functional activities, may be regulated under the guidance of psychoanalysis. On the other hand, most of the gynecologists and surgeons believe that very little can be accomplished by psychoanalysis. I believe the essence of the matter lies somewhere between the two extreme views and that much good can be accomplished by cooperation among those who have intelligent yet opposite views.

When I come on service in the Gynecological Department of the hospital I find it necessary to dismiss about 25 per cent of the patients who are sent from the clinic to the hospital for operation, because after many years' observation I have been convinced that whereas many of these patients display certain gynecologic and pathologic findings, operative interference would not benefit them sufficiently to warrant surgical



methods. I merely am impressed with the fact that the variety of complaints extended over such a wide field that nothing we could do surgically could possibly cure some of these patients. I would like to mention briefly a number of experiences to illustrate the statements I have just made.

One patient who was sent into the medical ward was referred to the gynecologic department for operation and, although she possessed a fibrotic uterus with some menorrhagia and metrorrhagia and although she had numerous abortions performed and lived in constant fear of becoming pregnant, her nervousness appeared to me to be her chief complaint. After a consultation between the psychiatrist and the internist I was persuaded to perform a hysterectomy on this patient, which I did reluctantly. Since the operation was performed this patient has acquired many new phobias to replace those which we may have eliminated for her. I am sure this patient should have remained in the hands of the medical man and the psychiatrist.

The only time I found myself solely responsible for that kind of management was when a very reputable medical man referred a patient to me for some plastic work and I agreed also to sterilize her. I saw her only once and did the operation. Several days later I had a letter from a brother of the patient calling all the curses imaginable down on me for having performed the operation. His doctor in Liverpool informed me the whole family was crazy and this patient is now in an asylum.

There is no question, to my mind, but that we must fall back on the psychiatrist and psychoanalyst for help in many of these cases. Early in my career I am sure I performed the Dudley operation for antelexion, the Gilliam ventrosuspension, dilatation and curettage far too often and in recent years I have very liberally used the sex hormones in cases of functional menstrual disturbances with no success whatsoever. I have been gratified by the help that I have been able to find from the psychiatrist and from the psychoanalyst.

Again, a patient in apparently perfect health wanted to get married but said she could not until her enuresis was cured. After careful gynecologic examination and careful study of her history I could elicit nothing which would respond to gynecologic treatment. This patient was treated by the psychiatrist and is cured and married.

Another patient whose only symptom was an intolerable pruritus vulvae, gave a very detailed history and displayed the scars of several operations and said she had been treated by every type of medical specialist except a psychiatrist. I, therefore, directed her to a well known psychiatrist and she is apparently cured.

Therefore, in conclusion, I would like to say that if we carefully evaluate and clearly interpret the gynecologic cases that come to us, of course making as certain as we can by every diagnostic method at our disposal that no gynecologic pathology exists, that in this large group of functional cases cooperation between the gynecologist, psychiatrist, and psychoanalyst will prove of benefit to the patient.

## THE IRREGULARITY OF THE MENSTRUAL FUNCTION\*

EDWARD ALLEN, M.D., CHICAGO, ILL.

(From the Presbyterian Hospital)

THE regularity of the menstrual function has been almost universally accepted by doctors, research workers, and lay people as a criterion of normality. Deviations from this rhythmic habit of any degree are interpreted as evidences of numerous pathologic conditions. Statistics and observations based upon statements from individuals who consider themselves normal and therefore believe that they are absolutely regular in their menstrual function have resulted in our present accepted opinion of menstrual periodicity.

One has only to practice obstetrics a short time to realize how inaccurate the ordinary patient can be about her menstrual periods. Yet almost all of the statistical studies of the menstrual periodicity are founded on the observations of the patients themselves. When pregnancy is either greatly feared or greatly desired there is no possible greater incentive for accuracy. Kelly,<sup>1</sup> in 1908, states that in 1000 cases, 942 reported a twenty-eight day interval and 22, a twenty-one day interval. This leaves only 36 patients who menstruated irregularly. In 1916 Sanes<sup>2</sup> reported an analysis of 4500 records and found that 75 per cent of the patients menstruated regularly. Seventy-two per cent of these were of the twenty-eight day type. Heyn<sup>3</sup> studied 1684 cases and found that 63.5 per cent were of the accepted twenty-eight day interval, 10.9 per cent menstruated every twenty-one days while 14.1 per cent varied from three to four weeks. Webster,<sup>4</sup> of this Society, says in his textbook that in about 86 per cent the menstrual type is regular. He allows 71 per cent for the twenty-eight day type; 14 per cent for the thirty day type, and states that the twenty-one day type is also found. He adds that a few other variations are found. Graves<sup>5</sup> in his recent (1929) textbook says, "Ideally the menstrual rhythm should be established quickly at intervals of twenty-eight days, though twenty-seven and thirty-one are within normal limits." Geist<sup>6</sup> in a study of 200 patients and a few female workers found a marked irregularity in their menstrual cycles. There was an eighteen to sixty day variation in the intervals between periods and the length of the flow was from twelve hours to eight days. Also the character of onset of the bleeding and the amount of blood lost were quite variable.

Bartelmez<sup>7</sup> has found definite evidence in his cytologic work on the cyclic phenomena in the human endometrium that would indicate that the process is quite irregular. Uteri removed at various stages of the menstrual interval did not always correspond with the stage of activity one would expect to find at that time. ✓

Our attention was called to the absolute irregularity of the menstrual function during a study<sup>10</sup> of the blood calcium levels between and during the menstrual flow. At the time we called for volunteers from the nursing school asking for those who were absolutely regular in their menstrual function. Those that responded stated that they were "as regular as clock work," "absolutely regular," or "menstruated on a certain day of each month." The periods which occurred during this observation varied from

\*Read before the Chicago Gynecological Society, June 17, 1932.

five to twenty days. Similar observations in the literature led us to study a larger group in the same way.

E. P. Foster,<sup>6</sup> in 1889, reported to the New York Medical Society accurate observations covering 380 menstrual periods occurring in fifty-six normal women. He found that only forty-five of these 380 periods occurred at an interval of twenty-eight days, 225 were shorter and 110 longer. The extremes were forty-six to sixteen days. Only one case exhibited a perfect regularity and that was at intervals of twenty-six days. The members of the society, in discussion, all thought that such irregularity must be due to some pathologic condition. Jessie L. King<sup>7</sup> found even a wider variation in rhythm after making a survey of 13 subjects during a study of the vaginal cycle, during which smears were taken every day. The interval in this series of 523 menstrual periods varied from eighteen to fifty-three days. None were regular. The majority of the periods, however, occurred between the twenty-second and the thirty-sixth day.

TABLE I

	ACCURATE	QUESTIONABLE
Total Number of Cases	110	21
Number of Periods	1291	231
Number of Individuals Showing Absolute Regularity	0	0
Number of Individuals Showing Absolute Irregularity	30	14
Variations in Interval	13 to 84 days	11 to 72 days
Duration of Periods	12 = 3 to 5 days 21 = 4 to 5 days 20 = 4 to 6 days 8 = 4 to 8 days 11 = 5 to 6 days 9 = 5 to 7 days 6 = 5 to 8 days	2 = 3 to 5 days 4 = 4 to 6 days 1 = 4 to 8 days 2 = 5 to 6 days 3 = 5 to 7 days 3 = 6 to 7 days
Number of Pads Used	50 = 6 to 12 60 = 12 to 30	10 = 6 to 12 11 = 12 to 30
Pain	Irregular = 37 Constant = 23 None = 50	Irregular = 6 Constant = 4 None = 11

The data included in this report were collected from the menstrual records of 131 members of a Nurses' Training School. One hundred ten of these cases were accurately controlled. The remaining 21 were open to a little question, but since the results are so nearly alike we have included them under a separate heading.

In all 1522 menstrual periods are recorded, 1414 in the controlled group and 231 in the questionable. At the onset of the period of observation the subjects were told the purpose and general plan of procedure, impressing upon them the value of accuracy and insisting that we would rather not have their records included if not certain of absolute accuracy. At this time they were asked to fill out a questionnaire. This questionnaire cov-

TABLE II. MENSTRUAL INTERVALS OF TYPICAL SUBJECTS

A	B	C	D	E	F
31	27	39	25	23	32
23	37½	27	25	27	32
29	33	47	26	22	21
29	35	25	24	28	36
22	32	23	20	25	27
37	35	28	54	22	41
23	31	49	42	31	32
27	35	24	25	27	30
28	30	21	29	45	30
23	28	29	25	32	28
21	30	34	30	27	31
24	29	25	16	25	35
24	27	27	25	51	26
25	31	26	22	28	37
26	26	29	27	19	26
55	29	26	25	28	35
22	29	27	24	24	27
21	27				26
23	33				31
27	27				24
25	26				33
26	25				36
16	27				
25	28	27	23	21	28

ered their impressions of their menstrual habit during the last five years. The questions asked were:

Have you menstruated with absolute regularity? What is the average duration, number of pads used, and are the periods associated with pain?

The school nurse of the home then began to check the menstrual periods. It entailed a tremendous amount of work and patience, and these results would not have been possible without her earnest cooperation. Slips were handed to her each month containing the data of that particular period. If reports were not in on the expected day a daily check was made until they were forthcoming. These slips were then transferred to a permanent calendar record.

The most striking fact gleaned from the above study is the marked ir-

TABLE III. ANALYSIS OF 1522 INTERVALS

ACCURATE	QUESTIONABLE
2—17 days	61—29 days
2—18 days	60—30 days
9—20 days	50—31 days
8—21 days	20—32 days
10—22 days	15—33 days
15—23 days	13—34 days
28—24 days	5—35 days
46—25 days	8—36 days
37—26 days	4—37 days
55—27 days	4—39 days
55—28 days	4—40 days

regularity of the whole process. Even among the 87 who thought in the beginning that they were absolutely regular, irregularity in interval, number of pads used and the length of the flow were very marked. Fifty-three of the group recognized that they were somewhat irregular but even they were surprised by the arrhythmia of the cycle.

During the period of observation records were kept as to the sort of duty the individual was performing during each month and period. Variation in occupation did not seem to appreciably affect the general cycle or vary the amount of dysmenorrhea, with the exception of duty in the general diet

TABLE IV. MENSTRUAL RECORD OF V. W.

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Time Studied: October, 1929, to October, 1931.

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Total Number of Periods = 25

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Pain: 15th period Senior duty second upper  
 17th period C Floor—day duty  
 20th period Operating Room

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Number of pads used: 4-4-4-4-5-5-6-4-4-4-3-5-3-5-4-4-4-4-5-4-5-3-5

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Number of days in period: 3½-4-4-4-3-5-5-5-4-4-4-1-5-4-5-4-4-4-4-5-4-4-5-5

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Intervals: 27-37½-33-35-32-35-31-35-30-28-30-29-27-31-26-29-29-27-33-27-26-25-27

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History of pain: Yes

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History of regular intervals: Yes, every 28 days "unless chilled or had wet feet."

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kitchen or the drug room where stepping into the large refrigerators in each place seemed to increase the amount of pain during such duty. Outside of this fact the reasons given to explain the irregularities were of no apparent importance. Forty-three of these 131 young women complained of pain of varying degree with every period, 48 had discomfort at irregular times and 55 had no discomfort worth mentioning.

If under regulated conditions these normal healthy young women have such marked variability in the menstrual function, then surely we must conclude that the same will hold true for normal women anywhere and that we should abandon our ideas that normally the periods are regular and usually at intervals of twenty-eight days.

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55 EAST WASHINGTON STREET.

#### ABSTRACT OF DISCUSSION

DR. GEORGE W. BARTELMEZ.—Dr. Carl Hartman has pointed out that the threshold for bleeding has become very low in the uterus, especially in primates and this

is an adaptation for providing the implanted egg with blood. In this connection I would say that normally there are various conditions which bring about extravasation in the uterine mucosa. The most important bleeding is that which follows implantation—the “placental sign” of Long and Evans. It is part of the cyclic ovulation—implantation mechanism. When the conditions are optimal we get (in the absence of fertilization) the typical pseudopregnancy which Schroeder, Meyer and others regard as the only normal type of cycle. This involves the maturation and rupture of a graafian follicle, corpus luteum formation with the associated uterine developments and after a more or less definite interval, the extravasation of blood. Frequently, however, the stimulus is not adequate to produce ovulation but there is nevertheless a certain amount of uterine development and eventually menstruation occurs. At other times there is little or no ovarian or uterine development but still bleeding occurs at the expected time. Finally, the stimulus may be below the threshold even for extravasation and a period is missed. There are, in other words, many transitions between optimal and subminimal conditions.

If this interpretation of the situation be correct, then the attack on the physiology of menstruation should begin with a study of the factors concerned in the implantation hemorrhage which is not confined to primates and probably occurs in all mammals. The recent experimental studies on the physiology of menstruation have only demonstrated that a variety of different conditions can produce the essential features of menstruation, i. e., extravasation of blood and some necrosis. I believe we shall make more progress by first establishing the normal sequence of events during menstruation and then by finding out what hormones are active or activated normally just before and during menstruation.

DR. JOSEPH BAER.—In the analysis of the data gathered by Dr. Allen, I am wondering whether he studied the number of periods in a given time interval per individual. For example, in a calendar year would the given young woman who thought she was accurate have twelve menstrual periods or perhaps thirteen, one a little more than twenty-eight days and the next at a little less than twenty-eight days but striking an approximate average of twenty-eight days.

I believe that the material used is not ideal. Nurses in training schools of hospitals are living under more or less artificial environment, both as to daily occupation and as to their surroundings. It occurred to me, having seen many nurses who have long periods of amenorrhea, whether it would not be well to carry on this investigation with a different type of individual, preferably the young woman in her own home, living what we would consider as nearly normal a type of existence as can be obtained in modern life.

✓ DR. N. SPROAT HEANEY.—After a study of a considerable amount of material over a long period of time, I have come to the conclusion that absolute regularity is rarely met with and that the patient who menstruates like clockwork is usually mistaken. ✓

DR. ALLEN (closing).—I have not analyzed these histories with the idea of whether or not there were twelve periods in a year. My general impression is that it would average about that. However, some menstruated at seventeen days and then jumped to forty, which might cut down the periods in the year.

I think the term regular irregularity would be better than irregular regularity. Only a few times in studying any case did the patient menstruate at twenty-nine, twenty-eight or twenty-six days; therefore, I think the term regular irregularity would be more appropriate.

We felt that these young women were living, perhaps, under more normal routine than the ordinary patient we see in the office. The fact that they were on duty did not seem to have any appreciable effect. It seemed to me that conditions were as normal as we could find in any group of women.

## DIABETES AND PREGNANCY\*

JOSHUA RONSHEIM, M.D., BROOKLYN, N. Y.

*(From the Service of the Jewish Hospital)*

THE cases of diabetes and pregnancy with which we are confronted from time to time may be divided into three groups; first, the diabetic who becomes pregnant; second, the pregnant woman who develops diabetes; third, the pregnant woman who at no time shows any evidence of diabetes but in whom, after a catastrophe has beset the pregnancy, evidence of a latent diabetes is established by her response to the sugar tolerance test. We are not concerned here with those cases in which, during pregnancy, lactose appears in the urine nor those in which in spite of the appearance of glucose in the urine, the blood sugar remains constantly at normal levels; these latter cases are the so-called renal diabetes; they are cases of low-sugar threshold and can be controlled by regulating the carbohydrate intake. Following are examples of the three types of cases.

CASE 1.—(No. 144926) Aged twenty-three; came to the prenatal clinic on Nov. 24, 1931, in her second pregnancy, the first having been terminated a year previously by therapeutic abortion. Three years prior to her visit there had been a gradual onset of all the symptoms of diabetes including a loss of fifty pounds in two years. Last menses began May 1. Urine showed 3.3 per cent sugar. Hospital observation was advised and six days later she was admitted to the medical service. She now had 3 per cent sugar in the urine with acetone and diacetic acid; blood sugar 278 mg. per 100 c.c.; blood chemistry otherwise negative. Under dietary regulation and insulin her condition improved insofar as the urine was concerned but the blood sugar remained high, being 250 mg. on December 3 and 300 mg. on December 8. On December 10 she was discharged from the hospital and readmitted two days later to the obstetric service, in labor, with membranes ruptured and a breech presenting. After a labor of about ten hours' duration, during which time the fetal heart disappeared, she was delivered of a stillborn premature female infant weighing 5 pounds 6 ounces. Since her discharge from the hospital she has been under the care of the diabetic clinic where, in spite of her lack of cooperation, she has gained some weight and the insulin has been reduced to 15 U twice daily. Her urine varies from sugar free to 2.7 per cent depending on her adherence or nonadherence to instructions.

CASE 2.—(No. 81469) Aged twenty-nine, came under my care on Sept. 29, 1923. She was in the last month of her third pregnancy. Her first pregnancy occurred three years before and was terminated by a forceps delivery resulting in a stillbirth. Whether this fetus was alive at the time of the instrumentation cannot be ascertained. She did not admit having been pregnant again until the present pregnancy but after her delivery she confessed to having had a five-month miscarriage one year after the first birth. Two days after her first visit to the office, at which time nothing unusual was found, she reported absence of fetal movements and examination confirmed the death of the fetus in utero. Sixteen days later she had a spontaneous delivery of a macerated fetus weighing 8 pounds 6 ounces. Several examinations of the urine prior to delivery were normal but on admission to the hospital blood sugar was 230 mg. and a few days

\*Read, by invitation, at a meeting of the New York Obstetrical Society, October 11, 1932.

later sugar appeared in the urine. Under dietary regulation and insulin the urine became sugar free and the blood sugar returned to normal.

CASE 3.—(No. 25251) Aged thirty-one. Her first pregnancy, so far as can be determined, ran a normal course; labor occurred a few weeks premature and the baby died on the eighteenth day in deep jaundice. Fifteen months later a second pregnancy terminated in a premature birth; this child is living but is mentally defective. The present pregnancy began Jan. 11, 1932; the course was entirely uneventful, repeated urinary examinations and blood pressure readings being normal. However, on August 8, about ten weeks before term labor set in, a premature female of three pounds was born spontaneously and died within twenty-four hours. All investigations were normal but the glucose tolerance test done several days postpartum gave the following results:

Before ingestion blood sugar 107.1 mg. urine negative  
 1 hour later blood sugar 233.1 mg. urine negative  
 2 hours later blood sugar 214.3 mg. urine negative  
 3 hours later blood sugar 196.4 mg. urine negative

In the first case presented, we were dealing with a severe type of antegestational diabetes in a noncooperative patient who presented herself too late to be really helped; the second is a case of mild diabetes developing during pregnancy; with an honest history and earlier investigation the child might have been saved. The third case is one which may properly be called latent diabetes; her mother has diabetes and she will no doubt eventually become a frank diabetic.

Up to the time of the introduction of insulin in the treatment of diabetes not more than 5 per cent of these women became pregnant; since then this percentage has probably been raised. When pregnancy does occur it should be considered as a serious complication since the disease will be aggravated by the pregnancy and the patients, as a rule, are difficult to control. Some of our patients make only one visit to the clinic or present themselves only after fetal death has occurred; others, while regular in their visits are not cooperative in the management of the diabetes. On the other hand the pregnant woman in whom diabetes develops is rarely in danger (unless it be a fulminating type) because the onset is usually in the latter months and slow. It is, however, a real menace to the unborn child because its presence is usually unsuspected or undiscovered until miscarriage or premature birth of a baby that succumbs in a few hours to days takes place, or the patient goes to term but the evidences of fetal life disappear a few weeks previously. The diagnosis is dependent upon careful, frequent examinations of the urine and, more particularly, periodic determinations of the blood sugar. The latter is especially important in the patient who has a family history of diabetes, or the patient who has had previous miscarriages or stillbirths which cannot be satisfactorily explained. Elimination of the diagnosis of diabetes on urine examination alone is fraught with danger since the patient may have a high sugar threshold. The opposite is also true; sugar in the urine does not necessarily spell diabetes.

Maternal mortality before the days of insulin varied from 15 per cent to 30 per cent during pregnancy, labor, and the puerperium, with an additional 10 to 20 per cent, dying within the year following of diabetes or tuberculosis. A much higher mortality was reported by Offergeld who, in



1909, collected 57 cases of which 80 per cent died in coma during labor or the puerperium or within fourteen months thereafter. Since the introduction of insulin this mortality has been definitely lowered. Whether the pancreatic activity of the fetus is of value in the control of diabetes in the mother is questionable; the experiments of Carlson and his coworkers have been refuted by Markowitz and Soskin as recently as 1927. While there are undoubtedly some cases in which improvement occurs, the vast majority will be found to progress rather than regress as term is approached.

The effects upon the fetus are more severe. At least 50 per cent terminate in abortion, miscarriage, or premature birth. If the patient escapes these complications fetal death in utero during the last few weeks of the pregnancy is always to be considered. In addition, the deaths from prematurity, monstrosity, and diabetes in early infancy raise this mortality to 65 per cent or more. Here again the proper treatment with diet and insulin, especially if it be instituted early, should result in a decided lowering of the fetal mortality; nevertheless, we must not lose sight of the fact that the combination of diabetes with pregnancy is a treacherous one for both mother and child because we meet with numerous cases in which the presence of the disease is unsuspected until fetal death occurs; second, the glycosuria and the glycemia are so variable day by day that it becomes impossible to accurately judge the danger to the fetus; third, there seems to be no relationship between the severity of the diabetes and fetal mortality; last, the use of general anesthesia is apt to precipitate an attack of coma.

In view of all these possibilities it is becoming a recognized fact that when the child is an important factor in the case the unborn child's best interests are served by the performance of abdominal cesarean section about three weeks before the expected date of delivery. The fact that these mothers are prone to have larger babies than usual is an added reason for this procedure. The avoidance of prolonged labor and the use of spinal anesthesia reduce the possibility of coma to a minimum. Last, if it be deemed advisable to prevent future pregnancies, sterilization can be done at the same time. Abortion as a routine in the diabetic is to be condemned. The induction of premature labor, particularly in the primipara, because of the manipulation necessary, the length of time required, and the poor resistance of such a patient must be considered a dangerous procedure for both mother and child and must give way to abdominal section.

Since 1920 we have had 36 cases of pregnancy complicated by diabetes at the Jewish Hospital of Brooklyn, both ward and private. These women have had a total of 121 pregnancies resulting in 74 live babies a fetal mortality of 38.8 per cent. Were we able to exclude those live babies born before the appearance of the diabetes the fetal mortality would unquestionably rise to 50 per cent or more. The results of the 36 pregnancies handled by us were as follows:

ONSET	NUMBER	THERAPEUTIC ABORTION	MISCAR- RIAGE	PREMATURE LIVE	SB	TERM LIVE	TERM SB	TOTAL LIVE
Antegestational	27	7	1	3	4	9	3	12
Intragestational	9	1	1	1	2	0	4	1

Excluding those cases that were subjected to therapeutic abortion we have

Total number of cases	28		
Total live births	13		
Total stillbirths	13		
Miscarriages	2		
Antegestational onset	20	Live births	12
Intragestational onset	8	Live births	1
Maternal mortality	1		

At the present time we have under consideration the carbohydrate metabolism in pregnancy. This work will require considerably more time and when completed will form the basis of a report of which this paper may be considered an introduction. From the information already obtained and a study of these cases in conjunction with a review of the literature we believe the following conclusions may be drawn:

1. Latent diabetes is a greater menace to the fetus than frank diabetes.
2. With proper treatment and coöperation on the part of the patient fetal mortality should be considerably reduced.
3. Uncontrolled diabetes will almost invariably result in (a) miscarriage, (b) premature birth of a live child which may or may not survive, (c) death of the fetus in utero a few weeks before term.
4. Since the dangers to the unborn child are so great, cesarean section about three weeks before term must be seriously considered, particularly in the primiparous woman or where no previous pregnancy resulted in a live birth.
5. General anesthesia with ether or chloroform is to be avoided because of the danger of precipitating coma. The possibility of sloughing of the tissues from infiltration anesthesia must be borne in mind.
6. Repeated blood sugar determinations must be a part of routine prenatal care, since glycosuria may appear too late to prevent damage to the pregnancy.
7. In cases of recurrent miscarriages or stillbirths without determinable cause, the sugar tolerance test may indicate that the patient is a potential diabetic.
8. Determination of the sugar content of the amniotic fluid and of the fetal urine will help in establishing the diagnosis in some cases.

205 HICKS STREET.

#### ABSTRACT OF DISCUSSION

DR. O. P. HUMPHSTONE.—My impression, from personal experience, of the present standing of diabetes and pregnancy is very much in accord with Dr. Ronsheim's conclusions. I think that insulin has rendered the mother a great deal safer in pregnancy than formerly. My experience does not show that insulin gives us many more live babies than we used to have in diabetes; and this is very few. We should endeavor, I think, to

find out what it is that kills these babies. I have several cases where I tried twice to carry out a pregnancy in an established diabetic before pregnancy; and each resulted in intrauterine death just before term. I am inclined to think there is some justification in offering cesarean section two weeks before term in the interest of the baby to these particular patients if they insist on further pregnancy. I have no fear of surgery in a diabetic patient provided I have the case under the care of a competent internist who controls the diabetes as he sees fit.

DR. H. J. STANDER.—I do not think one can make a definite statement about a patient with diabetes at the beginning of pregnancy. The effects of pregnancy or the effects perhaps of the fetal pancreas on diabetes are questions of great interest and I am quite convinced from six cases that I studied throughout pregnancy that there is a good effect on many of the diabetic patients as a result of the pregnancy itself. We have seen four patients who had a blood sugar around 150-200; the sugar tolerance test was way up, at the fourth hour it was still in the neighborhood of 200 mg. There was not any question about the diagnosis of diabetes. About the seventh month of pregnancy the patients showed improvement, at the ninth month of pregnancy they had gone without using insulin, and approximately a month after their babies were born they reverted to their prepregnancy state of diabetes. So I am convinced that in the milder forms of diabetes pregnancy, either through the fetal hormone or through the fact that the carbohydrate is used up mainly by the child, as is evidenced by the large child, exerts a good effect on the diabetes. I cannot agree with the speaker and regard diabetes as always a very serious complication of pregnancy. Judging by the very severe cases of diabetes that I have had and those that we have studied, I believe if you get them early in pregnancy, the second month, and carry them through their pregnancy on a diabetic regimen in the hospital, having them come in for two or three days every second month and study them carefully, you can carry them through.

I cannot agree with the doctor on the desirability of cesarean section in diabetes because I feel that while insulin has done a great deal, the diabetic patient is not quite the risk for cesarean section, and with the results that we all know about in these children. I would not subject a patient with diabetes to section, even at the seventh or eighth month, to get a live child.

## PRIMARY CARCINOMA OF BARTHOLIN'S GLAND\*

W. BENSON HARER, M.D., F.A.C.S., PHILADELPHIA, PA.

(From the Gynecological Department of St. Agnes Hospital)

CARCINOMA of Bartholin's gland as a primary tumor is very rare. Rabinovitch, in the most recent contribution to the subject states that there are not over forty cases in the literature but unfortunately he does not append a complete bibliography. My own review of the literature reveals only thirty cases of which several are doubtful. Probably the earliest case reported was that of Klob, who in 1864 described a tumor of Bartholin's gland which had the appearance of a cystosarcoma of the nipple. In 1880, Sinn while making an autopsy, found a tumor of undoubted malignancy originating in Bartholin's gland in a woman twenty-eight years of age. August Martin, in his book cites a case of carcinoma of Bartholin's gland which recurred four years after removal of the original tumor. Geist in 1887 reported a case described as part tubular car-

\*Read at a meeting of the Obstetrical Society of Philadelphia, November 3, 1932.

cinoma and part scirrhus. Schweizer and Maekenrodt both reported cases in 1893, but omitted such important details as the type of tumor, metastases, and final result. In fact, many of the reported cases are quite incomplete so that we are unable to draw definite conclusions as to many interesting and important points. During the past forty years occasional contributions have been made to the subject, the most valuable of which are articles by O. V. Frisch in 1904, Sitzenfrey in 1906, Spenceer in 1913, and Falls in 1923. Only seven cases of primary carcinoma of Bartholin's gland have been reported in American literature and of these, Lynch's case is not fully described and Taussig's case is somewhat doubtful.

There has been much speculation as to the etiology of carcinoma of Bartholin's gland. Of course, nothing definite is known, but the same theories have been advanced as for carcinoma arising in other structures. Chronic inflammation is generally believed to be a predisposing factor in the development of carcinoma and has been present in many of the reported cases. A definite history of neisserian infection was present in only one case. The rôle played by heredity is not well established. Only two of the reported cases mention a history of cancer in the patient's antecedents. There was no history of direct trauma in any reported case. As in other cancers, carcinoma of Bartholin's gland is generally seen after the age of forty. In fact, more than half of the reported cases occurred in women of fifty or more years of age. The youngest was twenty-eight and the oldest ninety-one. It has been found in unmarried women but not in virgins. Because of the fragmentary character of many of the reports, the incidence of other possible etiologic factors cannot be determined.

Two types of carcinoma are possible in the previously normal Bartholin's gland: (1) squamous cell tumors arising in the ducts near the surface of the gland and (2) columnar cell carcinoma or adenocarcinoma arising in the acini or in the epithelium of the deeper portions of the ducts. Furthermore, it has been pointed out by Sitzenfrey, G. Noble and others that in cases of chronic gonorrheal infections of Bartholin's gland a metaplasia of the normal columnar epithelial cells of the deeper portions of the ducts, occurs with their conversion into squamous cells so that the entire excretory duct may be lined with squamous cells. Hence in such a gland, a carcinoma arising even in the deeper portions of the ducts would be of the scirrhus type. It is also possible that a carcinoma arising from the columnar cells of the deeper portion of the gland may, as the tumor develops and approaches the surface, come to resemble a squamous cell carcinoma, a phenomenon comparable to that seen in certain adenocarcinoma of the cervix uteri. In fact, it seems quite likely that this is the explanation of both Geist's and Spenceer's cases.

Because of the extreme rarity of the condition the correct diagnosis is rarely made although actually the diagnosis is easy when the possibility of cancer is kept in mind. The presence of a hard lump in the posterior part of the labium majus, painless at first, later becoming painful and accompanied by edema of the vulva and skin over Bartholin's gland and hard,

shotty enlargement of the inguinal lymph glands in a woman beyond the age of forty, should make one suspect carcinoma of Bartholin's gland. The chronicity of the disease, its failure to respond to ordinary therapeutic measures, the tendency to degenerative processes in the tumor, and biopsy in doubtful cases, establish the diagnosis.

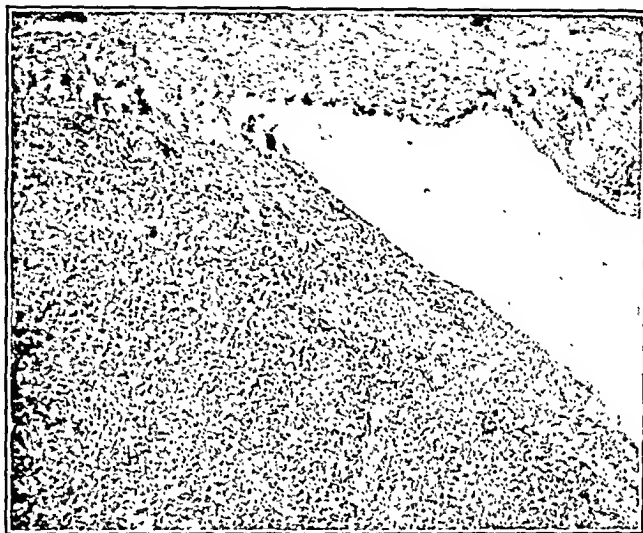


Fig. 1.—Low-power microscopic view of primary adenocarcinoma of Bartholin's gland showing duct. Magnified eighty diameters.

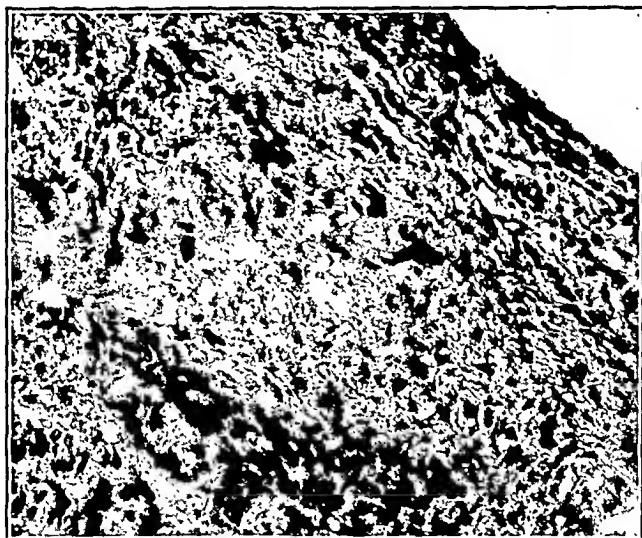


Fig. 2.—High-powered microscopic picture of primary adenocarcinoma of Bartholin's gland. Portion of duct is seen at upper right-hand corner. (280x.)

*Case History.*—Mrs. H. H., white, aged thirty-three, married, para 0, no miscarriages, admitted with a complaint of "Swelling at entrance to vagina and profuse irritating vaginal discharge."

About eight or nine months ago the patient first noticed a small, hard, painless lump in the posterior part of the left labium. It caused no discomfort so she paid no further attention to it until about April 1, 1932, when, during the course of a general physical

examination, she called the internist's attention to the mass. At that time she was told it was simply a small glandular cyst of no importance whatsoever but was advised to have it removed simply because it was growing larger. About this time she noticed a very irritating vaginal discharge which became more and more profuse and could not be relieved by ordinary douches. This continued until April 18, 1932, at which time she presented herself to me for treatment.

Patient's previous history uneventful and there was no malignancy in the family. Menstruation normal. Last period March 25, 1932. No pregnancies. No operations.

*Physical Examination.*—White adult female of good bony and muscular development, with a moderate enlargement of the thyroid gland, chiefly of the left lobe. The heart shows an extrasystolic arrhythmia but is otherwise negative. Pelvic examination reveals a hard lump about the size of a walnut in the left labium majus in the position of Bartholin's gland. It is freely movable and not tender. There is a slightly irregular or lobulated outline to the mass on careful palpation. The skin over the tumor is freely movable, slightly inflamed but otherwise normal. No enlargement of any of the regional lymphatics could be detected. The skin of the inner surface of the thighs and of the labia is moderately inflamed. The vaginal mucosa is inflamed and bathed in a thin watery secretion. The cervix is inflamed but otherwise presents the normal appearance of a nulliparous cervix. The uterus and adnexa are normal.

Vaginal smears were negative for gonococci but showed *B. coli* and *Trichomonas vaginalis* in large numbers.

Blood count normal.

A diagnosis of tumor of Bartholin's gland was made and operation advised. Because it was nearly time for her menses, the patient would not submit to operation until May 2, 1932. At that time the tumor was excised under nitrous-oxide-oxygen anesthesia. It was encapsulated and shelled out with the greatest ease. The incision was closed with interrupted catgut sutures and healed by primary union. The patient was discharged from the hospital on the fourth day and told to report to my office for further treatment of her leucorrhea. The malignant character of the tumor was not discovered until sections were cut and studied. An attempt was then made to communicate with the patient but it was discovered that she had gone out of town on a vacation. Her husband was accordingly acquainted with the facts of the case, and upon return of the patient, she was again taken to St. Agnes' Hospital where on July 18, 1932, she was given 1200 mg. hr. of radium over the affected area, and a careful search again was made for possible evidence of lymphatic involvement. At that time the left labium was perfectly healed and free of all induration. No evidence of metastasis or recurrence was found. Her vaginal discharge cleared up promptly with the use of tincture of green soap followed by the application of 5 per cent solution of mercurchrome and the liberal use of kaolin and soda bicarbonate.

*Pathologic Report.*—Gross examination: The specimen is an irregular lobate tumor 3 by 2 by 1.5 cm. which apparently has been well encapsulated and this capsule with underlying parenchyma has been incised at one place. When sectioned the substance is firm, pale, and quite homogeneous in texture. Sections cut from both ends.

Microscopic examination: Sections show the mass to consist, almost entirely, of epithelial cells massed together in an irregular fashion or sometimes arranged in incomplete alveoli. Many of the nuclei of these cells are large and granular. In an occasional nucleus are seen mitotic figures. Along the edge of one section there is seen a duct which closely resembles the ducts usually seen in Bartholin's gland.

*Diagnosis.*—Adenocarcinoma of Bartholin's gland.

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### ABSTRACT OF DISCUSSION

DR. JOHN A. McGLINN.—I have never seen a case nor can I recall a similar case having been presented.

There is no gland, with the possible exception of the salivary, which works more intensively and more frequently to fulfill its physiologic function in the body, and none as subject to great and more frequent traumatism, or to more widespread infection. And yet in spite of all this, carcinoma occurs but rarely, so rarely that in all the literature of the world only forty cases appear.

## DÖDERLEIN'S BACILLUS IN THE TREATMENT OF VAGINITIS\*

ROY W. MOHLER, M.D., F.A.C.S., AND CLAUDE P. BROWN, M.D.,  
PHILADELPHIA, PA.

(From the Gynecological Department of Jefferson Medical College)

WE ARE presenting a preliminary report on the treatment of vaginitis with pure viable cultures of Döderlein's bacillus. So far as we know this form of treatment has not been reported in American literature. A statement of the favorable results secured and an explanation of the physiologic principles upon which the treatment is based are the purposes of this report.

In contemplating any treatment for vaginitis which may be the cause of leucorrhea we must first exclude the possibility of a latent infection of the cervix and Skene's tubules. The cervix is excluded as the source of the vaginitis when there is no eversion or erosion present and when its secretion is moderate in amount and contains none or only a few pus cells. The Skene's tubules are regarded as normal when there is no granulation about them and when no pus cells and only a few epithelial cells can be recovered from them.

*Past Treatment.*—In most of the published reports in the English language with which we are familiar, mechanical cleansing of the vagina and the application of antiseptics have been the basis of treatment for vaginitis, particularly the so-called *Trichomonas vaginalis* vaginitis.

\*Read at a meeting of the Philadelphia Obstetrical Society, November 3, 1932.

Mechanical cleansing is a very important factor, but it is inadvisable to so thoroughly cleanse the vagina that the natural resistance of the mucosa is impaired by the trauma produced by scrubbing. Antiseptics may be used which will kill the parasites and most of the bacteria present in the vaginal canal, but they may also impair the normal activity of the mucosa to a point where its autogenous property of overcoming infection is lost.

*Normal Vaginal Secretion.*—There is undoubtedly a physiologic mechanism which maintains a balanced secretion in the vaginal canal from infancy to old age. There are occasional glands present in the mucosa of the vaginal canal. The mucus from the cervix and the glycogen containing epithelium of the vagina are the normal sources of the vaginal secretion.

Abrahams<sup>2</sup> from his observations maintains that the healthy infant has an acid vaginal secretion and that in children with chronic diseases this changes, becoming alkaline. According to the Schröder school, the vaginal bacillary flora prevails after one year of age. These authors regard the bacillary flora of the vagina as normal in healthy children. In the normal woman past puberty, the normal vaginal secretion consists of epithelial cells and vaginal bacilli of Döderlein with a high concentration of lactic acid which is considered important for the self cleansing of the vagina. A number of writers are of the opinion that the lactic acid is formed from glycogen under the influence of these bacilli found in the vagina. According to some authors the degree of acidity of the secretion and its variations are dependent on the glycogen found in the vaginal walls and is influenced by the general condition of the vaginal membrane. Schröder, Puplosky, Demme and others assume that the glycogen is transformed into a monosaccharide as the result of fermentation and that the monosaccharide serves as the material for the formation of the lactic acid when acted upon by some bacilli of the vagina. This assumption is based on the fact that the vaginal bacilli grow poorly in a glycogen containing culture and in such cultures no acid formation takes place. If this be true it would seem that all women should be free of symptoms during the childbearing age regardless of parity when there is no hypersecretion from the cervix and when the vaginal secretion is acid in reaction and consists of epithelial cells and Döderlein's bacilli.

The physical characteristic of the vaginal canal seems much altered after the artificial or natural menopause. This is, of course, very difficult to determine definitely, since one must draw conclusions from patients who have symptoms. The impression that is formed after examining many patients who have passed the menopause is that atrophy has occurred, the cervix is small, the mucosa is thinner and not as succulent as in the childbearing woman. The vaginal secretion is reduced in amount, thinner in consistency, white in color and not flaky as found in the premenopausal woman; it contains epithelial cells, many pus cells and many organisms of various types, both cocci and bacilli; the hydrogen ion con-



centration seems to have changed becoming less acid in reaction; the vaginal bacilli of Döderlein are absent. Although the vaginal secretion seems to change after the menopause many of these patients do not complain of leucorrhea. It would seem that the atrophy of the vaginal mucosa and the reduction of its glycogenic function together with a lessened secretion from the cervix would explain the absence of discharge sufficient to cause a leucorrhea.

#### FLORA OF LEUCORRHEA

After these remarks and hypotheses regarding the normal vaginal secretion it seems desirable to discuss the question of the bacterial flora of the pathologic vaginal discharge. Curtis<sup>3</sup> made a very extensive study of the etiology and bacteriology of leucorrhea. He concluded that "fresh preparations from the uncontaminated vaginal canal show almost exclusively Döderlein's large gram-positive vaginal bacilli. Most clinically normal women show bacilli of this type. The more patients deviate from the normal with regard to Döderlein's bacilli, the greater the tendency to discharge formation and the more purulent its nature. The characteristic of smears and cultures from leucorrheal discharges is the preponderance of anaerobic organisms." Since Curtis published his work, the *Trichomonas vaginalis* has been cited as one of the chief causes of vaginitis. Within the last few years much literature has appeared on this subject and many treatments have been advised.

Without entering a controversy upon this matter it would seem that, although one can see the *Trichomonas vaginalis* frequently when vaginitis is present, there are also other factors which are fairly constant and cannot be ignored; the organisms referred to by Curtis, the constant changes in the vaginal wall and introitus of the vagina, characterized by mottling and redness, especially, marked in the fornices and the vestibule of the vagina and the frequent appearance of droplets of serum transudate on the mucosa of the vagina and portio. We must then consider whether the changes in the vaginal wall are secondary to infection with the *Trichomonas vaginalis* or other organisms, or whether the changes in the vaginal canal are primary and the contamination with these organisms secondary. If the changes in the vaginal canal are primary, the endocrine system may be a factor in the production of vaginitis. This is substantiated theoretically by two observations; namely, the change in the vaginal secretion after the menopause and the improvement of some of these patients after the use of glandular therapy, viz., thyroid extract. The determination of the importance of the endocrine factor in vaginitis is not the purpose of this report; to prove this would involve very extensive studies, which so far as we know have not been completed; that is, the study of the vaginal secretion and flora throughout the menstrual cycle, first of the normal woman and second of the diseased patient. These studies should be made on a large series of cases at not more than five day intervals throughout a number of menstrual cycles.

## BIOLOGIC TREATMENT

The treatment of vaginitis by means of some biologic principle has been tried a number of times. Llewellyn and Block<sup>1</sup> in 1917 gave a report based on the use of *Bacillus bulgaricus* which was rather satisfactory when one considers that at that time eversion of the cervix and endocervicitis were not being treated so frequently with the cautery as at present. Yeast fungi of the *saccharomyces cerevisiae* or brewing type has been used by some for a considerable period of time with a fair degree of success. Loeser, Andreitschuk, Smorodintzeva and Tumanoff, and other foreign investigators have given reports on the treatment of vaginitis by planting pure cultures of the vaginal bacillus in the vagina. Our first attempt to develop a treatment for vaginitis by some biologic means was to use sugar of milk in the vagina after a cleansing douche of plain water, the idea being to supply a medium for the development of lactic acid from the flora present. The next thought was to use together with the sugar of milk some type of aciduric organism which would develop lactic acid in the vagina. Thomas<sup>2</sup> reported that the *Bacillus acidophilus* and Döderlein bacillus were identical, and since the *Bacillus acidophilus* was easily available, it was used with the sugar of milk. After some time the *Bacillus acidophilus* and sugar of milk treatment was replaced by the present treatment.

## METHOD OF TREATMENT

About nine months ago one of us (M) made a culture from a vaginal vagina that appeared normal. Bacteriologic studies convinced one of us (B) that the organism isolated was the one described by Döderlein and this is the one used in the work herewith reported. This culture has been studied together with *Bacillus acidophilus* and while culturally similar is serologically different. The Döderlein culture used is grown in a whey medium and after suitable growth it is prepared by mixing one-half ounce with enough sugar of milk to make a thin paste. The mixture is planted in the vagina after cleansing with dry cotton and a small cotton tampon is then placed in the vaginal introitus. The treatment is carried out once every twenty-four hours either by the physician or patient. If the patient carries out the treatment she does it preferably before retiring. After a cleansing douche of plain water the mixture of one-half ounce of the culture and sugar of milk is injected into the vagina with a soft rubber ear syringe the patient assuming a reclining position with the hips slightly elevated. A small tampon of cotton is placed in the vaginal introitus, and removed the following morning. The patient reports at weekly intervals for check-up and study. Routine smears of the vaginal canal are made on each visit, when the secretion appears normal and when large numbers of Döderlein's bacilli are seen in the smears after staining, cultures are then taken to determine if the planted organisms can be recovered.

All of the patients treated complained of a leucorrhoeal discharge

which had failed to respond to other methods of treatment, such as cauterization of the cervix and Skene's tubules and the application of antiseptics following thorough cleansing of the vagina. The vaginal secretions were studied by making the ordinary hanging drop unstained smear, and the *Trichomonas vaginalis* was frequently present. The stained smears contained many pus cells, epithelial cells and many types of organisms which we did not try to classify. The vestibule of the vagina was hyperemic and the vaginal wall showed various degrees of reddening and mottling which was especially marked about the fornices and portio. The Döderlein bacillus was constantly absent.

#### RESULTS OF TREATMENT

Twenty-one patients were treated. Six of these failed to carry out treatment as recommended, but were improved so far as the symptom of leucorrhea was concerned while following the treatment. Nine patients are still under observation, the hyperemia and mottling of the vaginal canal having disappeared, the vestibule of the vagina looks normally pink except in a few where there is a small area of hyperemia about the orifices of Skene's tubules. The number of pus cells in the secretion from these areas is interpreted as implying that there is present a focus of infection which has not been destroyed. In some the mottling has persisted about a discrete area on the portio. These nine patients have remained symptom free with irregular treatment but they have not as yet responded to our criteria of cure. Six patients have remained symptom free, and we have recovered from their vaginal secretion cultures of the organisms planted.

Proof of cure was based on absence of symptoms, the inability to find pus cells in large numbers in stained smears, failure of the vaginitis to return after treatment has been discontinued and finally recovery of cultures of the implanted organisms from the vagina of the patient treated is our proof of cure.

In presenting this report we are conscious of the fact that the treatment is more or less in the experimental stage and has not been given a long trial, it is preliminary to one on a larger series of cases.

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323 SOUTH TWENTIETH STREET.

#### ABSTRACT OF DISCUSSION

DR. CLAUDE BROWN: Our interest in the Döderlein bacillus was aroused by Dr. Mohler's observation that the vaginal tract, under normal healthy conditions, contained large number of Döderlein bacillus and particularly, if not entirely absent in those with vaginitis.

Two cultures have been under rather intensive study; these were both obtained by Dr. Mohler. The carbohydrate reactions were of no help. We, therefore, immunized some rabbits against these and *B. acidophilus* cultures, and then made agglutinations and adsorption studies with the sera of these rabbits. This work leads us to believe that Döderlein bacillus and *B. acidophilus* belong in the aciduric group, but are separate entities. We feel fairly certain that Döderlein's bacillus is not the *acidophilus* used in milk preparations and cultures used by the gastroenterologists, although Thomas in his studies reported them as identical.

Because of the difficulties encountered in classification, Döderlein bacillus has not yet appeared in Gergey's *Manual of Determinative Bacteriology*. However, studies are in progress which we hope will clear up the discrepancies.

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## ASCHHEIM-ZONDEK PREGNANCY TEST, FRIEDMAN MODIFICATION\*

WITH REPORT OF 174 CASES

BERNARD MANN, M.D., F.A.C.S., DAVID MERANZE, M.D., AND  
LEIB GOLUB, M.D., PHILADELPHIA, PA.

(From the Gynecological Department of Mt. Sinai Hospital)

A TEST based on biologic findings and procedure is subject in its very nature to many limitations, both qualitatively and quantitatively. Such limitations are inherent both in the test material and in the experimental animal. However, there are often fundamental mechanisms which can be relied upon in a great percentage of cases, provided certain conditions are stabilized. If, moreover, biochemical accompaniments of such mechanisms can be found, a successful procedure may be developed. The many functional tests in general use, often fall down in special instances because compensatory mechanisms, margins of safety and individual variations come into play: for instance, in the performance of the glucose tolerance test or in the phenolsulphonphthalein test. In the test we are about to discuss such considerations hold to a lesser degree.

Many procedures have been proposed for the detection of early pregnancy. Besides the Aschheim-Zondek test<sup>1</sup> and its modifications the most important proposals have been those of Broeha,<sup>2</sup> Bereovitz,<sup>3</sup> and Manoilov.<sup>4</sup> These latter procedures have been studied comparatively by White and Severance<sup>5</sup> in a fairly large series of cases, and have been shown to be decidedly inferior in dependency to that proposed by Aschheim and Zondek.

The test as proposed by Aschheim and Zondek has certain practical disadvantages. It is admittedly difficult to have on hand, except in the more completely equipped laboratories, the large number of immature white mice required for the test, since for each test four to six such animals are necessary. Furthermore, if the mice are not used before the twenty-fourth day of their existence they mature and are of no further value for this

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\*Read at a meeting of the Obstetrical Society of Philadelphia, November 3, 1932.

purpose. The technic, moreover, is quite tedious. The long time interval of one hundred hours is also a considerable disadvantage if the test is being used to determine the possible existence of an ectopic pregnancy.

A decided practical advance was achieved when Friedman<sup>7</sup> proposed the use of the rabbit as a test animal and later demonstrated along with other workers<sup>8</sup> the dependability of this procedure. It had long been known that in the doe, the cat, and the ferret ova continually ripen, but ovulation does not occur without copulation, or its mechanical equivalent, such as stroking the vagina and the jumping of females. The ripe graafian follicles exist as large vesicles in the nonovulatory rabbit and are readily recognizable. With ovulation they rupture; the follicle is converted into a corpus hemorrhagicum and this in turn to a corpus luteum. Ovulation, therefore, is not cyclic but conditioned. Friedman in a series of preliminary physiologic experiments demonstrated that ovulation could be induced without coitus in a number of ways. One such way was the intravenous injection of urine from pregnant women. He, therefore, suggested that this phenomenon could be used as a test for early pregnancy. The suggestion was immediately taken up by various workers, and very favorable results reported.<sup>5</sup>

It is such a series of cases that we wish to report. The Friedman modification has all the advantages of the original Aschheim-Zondek test and a number of practical superiorities, which will become evident as we discuss the test in detail. The test animal is a nonpregnant doe, over three months old or weighing more than four pounds. The doe should be kept in isolation for a period of four weeks prior to use. No large supply of animals need, therefore, be kept on hand. The urine used is usually a fresh morning specimen kept on ice over the period of its administration. The specimen should also be warmed to approximately body temperature before injection. If turbid, it is probably advisable to filter and to render slightly acid. We inject about 30 c.c. of urine over a period of two days, usually in 5 c.c. portions as recommended by Friedman. This procedure can be varied within limits. Our technic differs from others in some respects. Many inject much smaller quantities and laparotomize and examine after twenty-four hours. In negative cases, these workers reexamine the animal after forty-eight hours. Our usual routine is to examine after forty-eight hours from the time of the first injection. We have deviated from this in this series only under very special circumstances and have found that the procedure has met the requirements of problems presented by hospital and private cases. This time interval, forty-eight hours, it will be noted constitutes a distinct time advantage over the original Aschheim-Zondek test. Larger quantities than 5 c.c. may be administered in one injection and in special cases the animal can be examined after one day, always with the stipulation that if the test prove negative at that time the animal should be reopened twenty-four hours later.

The appearance of the ovaries is quite characteristic. The detailed ap-

pearance of the ovaries in negative and positive cases has been described in many papers. We would like, however, to list a few observations which we consider interesting and important. While the freshly formed corpora lutea are almost always characteristic in appearance, yet occasionally an old corpus luteum may simulate it closely. Positive ovaries show the large corpora hemorrhagica which are almost black in color with or without ruptured follicles. An old corpus hemorrhagicum in contrast is usually smaller and has a reddish rather than a blackish tint. In doubtful instances the ovaries can be sectioned and the suspicious area studied histologically. We have resorted to this procedure with satisfaction in a number of instances. The site of the hemorrhagic area should also be studied with care since in one instance in our series a hemorrhagic cyst of the same size and appearance as that seen in positive ovaries was found outside of the ovary, in the meso-ovarium. The ovaries in this particular case were entirely negative, macroscopically and microscopically. We, too, have obtained some aid from the gross appearance of the horns and uterus on opening the abdomen. These are in the positive cases usually darker in color and edematous.

Very frequently the enlargement of the mammary glands may suggest the outcome of the test even before laparotomy. This enlargement corresponds microscopically with a hyperplasia of the glandular elements of the mammary glands. We would like to caution the workers with rabbits not to place absolute reliance on the testimony of their dealers, as occasionally, male rabbits are sent in and in this way valuable time and sometimes irreplaceable material are lost. Examination of the rabbit immediately before use as to its sex will prevent this mistake. It may be advisable in the event that the injected urine produces death in the animal by virtue of some toxic property to detoxify the urine by extraction with ether as recommended by some authors. It has been our experience that operating in the Trendelenberg position immediately after etherization greatly facilitates and shortens the operation.

In the operation itself no sepsis need be observed. The resistance of the animal to infection is remarkable. Even under the most adverse operative conditions the animal morbidity and mortality are low. On re-opening rabbits a second or even a third time we find invariably that no active infection is present. However, we very frequently find in these reoperated rabbits adhesions and cysts, chiefly within the abdominal wall, cysts filled with sebaceous-like material. On sectioning these cysts, we find them lined in part by stratified epithelium and filled with necrotic infected matter, very effectively circumscribed. In addition the animals seem to suffer slight ill effects from traumatic injuries to bladder or intestine, if these are punctured and repaired. We feel, however, that an animal should not be used more than twice, particularly in view of the one false negative to be described.

It is now our purpose to analyze the results of 174 consecutive tests in

which we employed the Friedman modification of the Aschheim-Zondek test. Nearly all of these were problem cases in which help was sought from the test used and in which subsequent procedure was guided by the results so obtained. All of our cases were followed up clinically. In this series we obtained 91 positive tests on 79 cases. Pregnancy was definitely established in 77 of these cases. There were two positive results in conditions other than pregnancy. We describe these further on in detail. There were two incorrect positives, giving a percentage of accuracy of 97.8 per cent. The results of this group are given in Table I. We considered pregnancy as established two weeks following the last menstrual period.

TABLE I. ANALYSIS OF POSITIVE TESTS

NO. OF POSITIVE TESTS	NO. OF TESTS IN PROVED PREGNANCIES	NO. OF CORRECT POSITIVE TESTS IN CONDITIONS OTHER THAN PREGNANCY	INCORRECT POSITIVES	PER CENT OF ACCURACY
91 (79 cases)	89 (77 cases)	2	2	97.8

Table II represents the number of cases diagnosed at the various stages of pregnancy noted. These were:

TABLE II. STAGES OF PREGNANCY GIVING POSITIVE RESULTS

UNDER ONE MONTH	SECOND MONTH	THIRD MONTH	FOURTH MONTH	FIFTH MONTH	SIXTH MONTH	SEVENTH MONTH	EIGHTH MONTH
17	29	13	9	5	2	1	1

Citation of the following positive cases is of interest.

CASE 1.—One patient having regular menstrual history up to September 5, 1931, developed irregular bleeding, elevated temperature, and pain in the lower abdomen. A pregnancy test done November 7, 1931, was positive. An unruptured ectopic pregnancy was suspected. A laparotomy was performed and the diagnosis of unruptured ectopic pregnancy confirmed.

CASE 2.—One patient had amenorrhea of two months' duration. A pelvic examination showed the uterus to be enlarged to the size of a two months' pregnancy, and in addition bilateral cysts of the ovary. A pregnancy test done at this time was positive. A laparotomy was performed. The cysts proved to be dermoid in character. One ovary also contained a corpus luteum of pregnancy.

CASE 3.—This is a case of a woman of approximately three and one-half months' pregnancy on whom a test was positive. The patient had an ovarian cyst which suddenly became twisted on its pedicle. A laparotomy became imperative and was performed on the same day. The diagnosis of a twisted ovarian cyst was substantiated. The patient was discharged in good condition. Signs of a viable fetus which had been present suddenly disappeared in the sixth month of pregnancy. Bleeding ensued. A test performed at this time was negative. A dilatation was done and a dead fetus and other products of conception were obtained.

The two positive results in conditions other than pregnancy are the following:

CASE 4.—One patient, twenty-two years of age, presented herself with a normal menstrual history followed by periods of amenorrhea and vaginal bleeding. A curettage was performed and a pathologic diagnosis of hydatidiform mole was made. The subsequent tests were negative.

CASE 5.—Mrs. S., aged thirty-two, was admitted to the hospital with a diagnosis of hydatidiform mole. Pregnancy test at this time was positive. This diagnosis was substantiated by a curettage. The test continued positive for three months following which period they have remained negative for the ensuing eleven months.

Two false positives were obtained in our series. The first instance of an incorrect positive was that of a patient twenty-eight years old, para iv, who missed one period. A urine specimen collected at this time gave a positive result. A few days later the patient had a menstrual flow.

The history of the second case reported to us, was acute lower abdominal pain and amenorrhea of three months' duration. The test for pregnancy was positive. Ectopic pregnancy was suspected. A laparotomy was performed. No ectopic was found. One month later the patient passed a "piece" of tissue which unfortunately was not submitted for an examination. Following this the patient was admitted to the hospital, and a curettage was performed because of continued bleeding. The pathologic diagnosis on the tissue so obtained was hyperplasia of the endometrium. The pregnancy test at this time was negative. Though there is a possibility that the "piece" of tissue expelled contained products of conception we are listing it as a false positive.

Eighty-three tests (71 cases) were negative. Of these in 70 cases pregnancy was definitely excluded by our follow-up. One test was incorrect, giving a percentage of accuracy of 98.8.

TABLE III

NO. OF NEGATIVE TESTS	NO. OF TESTS PROVED NEGATIVE CLINICALLY	NO. OF INCORRECT NEGATIVE TESTS	PER CENT OF ACCURACY
83 (71 cases)	82 (70 cases)	1	98.8

The following were the final diagnoses in these 70 cases: 4 cases of uterine fibroma, 5 cases of lactation amenorrhea, 1 case of tuboovarian abscess, 5 cases of dead fetus, 29 cases of missed one period (had period next month), 8 cases of irregular menstrual bleeding, 1 case of very scant menstruation at the time of last period (married seven months), 3 cases of displaced uterus, 1 case of nausea and vomiting (gastritis due to ascaris lumbricoides), 1 case of tenderness in the left lower abdomen (suspected ectopic), 2 cases of pseudocyeses, 1 case of sclerotic ovary and adhesions, 1 case of the last period lasting only three days instead of usual seven days, 4 cases of amenorrhea and menopause, 1 case of chronic salpingitis, 2 cases of endocrine dysfunction, and 1 case of incomplete abortion (bleeding for ten days).

The single instance of a false negative occurred during a demonstration of the accuracy of the test. Two separate portions of a known positive urine were injected into two rabbits. One of these rabbits had never before been used for this purpose. The other rabbit had been so used on two previous occasions. In the former rabbit the result was positive. The



latter rabbit was negative. In its abdominal wall were found many cysts containing a sebaceous material and also many adhesions between the intestinal coils and between the intestinal coils and abdominal wall.

In summarizing the results we performed 174 tests, of which 171 gave correct results, giving a percentage of accuracy of 98.2.

TABLE IV

NO. OF TESTS	NO. OF CORRECT RESULTS	PER CENT OF ACCURACY
174	171	98.2

In conclusion we may state:

The results of this series of 174 tests have demonstrated the value of the Friedman modification of the Aschheim-Zondek test in the diagnosis of early pregnancy.

It has further proved of invaluable assistance in the differential diagnoses of suspected pregnancy, hydatidiform mole, and chorionepithelioma from a large variety of conditions simulating them.

The test has in two instances enabled us to follow the course of hydatidiform moles in a manner previously impossible.

The Friedman test is practical, easily performed, and readily adaptable in the ordinarily equipped laboratory, and permits of an unusually high percentage of accurate diagnoses.

245 SOUTH SIXTEENTH STREET.

#### ABSTRACT OF DISCUSSION

DR. CHARLES MAZER.—This report, coming from a man who utilized the test from the clinical and not laboratory standpoint, is of great importance in evaluating the Friedman pregnancy test in problem cases. When the test is employed on normal, nonpregnant women, the results are misleading, for in them we rarely encounter a false, positive reaction.

There is no doubt that the Friedman modification of the Aschheim-Zondek pregnancy test is superior to the original test. It practically requires no technical experience. The country physician without laboratory facilities can perform the test with accuracy. If he encounters difficulty in entering the marginal ear-vein, the subcutaneous injection of a larger quantity of urine will render equally good results. Because of the simplicity of the procedure and the availability of the test animals, the results are more accurate.

The Friedman test, like all other biologic tests, is, however, not free from an element of error when employed in problem cases. The false, positive reactions are most embarrassing, leading to unnecessary operations in the diagnosis of unruptured ectopic gestation and other conditions.

There is always a remote possibility of an excess production of anterior pituitary sex hormone in the nonpregnant woman suffering from a primary ovarian failure, hyperthyroidism or a large ovarian cyst, mistaken for a pregnant uterus. I am, therefore, employing the Friedman and estrin tests simultaneously. When the two tests agree, we are fairly sure of an accurate diagnosis. If, however, they disagree, the negative test is repeated.

The question is often asked why the urine should be acidified, if alkaline, before the injections are given. It must be remembered that the gonad-stimulating hormone is unstable in an alkaline medium and the acetic acid is added to the alkaline urine in order to preserve the stability of the hormone.

DR. MANN (concluding).—Up to our ninetieth case our results were correct 100 per cent. I suppose, that as our number of tests increase, our percentage of correct results may not be as good as they were in this series.

## INJURIES TO THE VAGINA RESULTING FROM THE ELLIOTT TREATMENT\*

SAMUEL A. COSGROVE, M.D., F.A.C.S., AND  
EDWARD G. WATERS, M.D., F.A.C.S., JERSEY CITY, N. J.

THE "Elliott Treatment" is a means of applying heat to the pelvic tissues by means of a mechanical device whereby water at temperatures up to 130° F. is circulated under pressure through a collapsible bag introduced into the vagina or rectum. The procedure has been enthusiastically recommended for a variety of acute and chronic pelvic inflammatory states. It may well be considered a priori that prolonged and/or frequently repeated exposure of tissues to such a degree of heat may be productive of local damage to these tissues.

The following cases are presented without discussion either of the propriety of the indications for treatment, or the competence of the technic involved, to show that such damage with reference to the vagina does actually occur.

CASE 1.—(E. G. W.) T. D., thirty-four years, meningitis and diphtheria in early childhood, with complete recovery. Pleurisy (tuberculosis ?) nine years ago. Appendicectomy and tubal resection eight years ago. Married fourteen years, three living children.

No miscarriages. Menses, regular type, but last only two days. For the past 6 or 8 years, has had a persistent vaginal discharge, and for past six years has been treated at intervals for "ulcers of the womb." Also, has persistently used medicated douches. A few years ago was curetted for the same trouble. Accompanying the discharge there has been a constant pain felt low down on the left side, aggravated by constipation and especially by intercourse. There are no urinary or digestive symptoms. The appetite is fair and the patient sleeps well. In the past year the patient has lost 18 pounds, the present weight being 120¼ pounds. Fairly well developed and nourished. Presented tenderness in the left lower quadrant. Parous but fairly tight introitus. Cervix site of numerous nabothian cysts. Uterus slightly enlarged. Small sessile fibroid on the anterior surface of the uterus. Both adnexa slightly enlarged and *very* tender.

The cysts were destroyed with the cautery. A series of Elliott treatments was begun, as follows:

1/13/32—35 minutes, 2 pounds' pressure, 128° to 130°  
1/20/32—40 minutes, 2 pounds' pressure, 128° to 130°  
1/25/32—40 minutes, 2 pounds' pressure, 128° to 130°  
1/29/32—40 minutes, 2 pounds' pressure, 128° to 130°

\*Read at a meeting of the New York Obstetrical Society, October 11, 1932.

Inspection of the vagina at the time of the next visit, February 3, showed marked burns of the cervix and upper vagina, the whole of the upper three-quarters of the vaginal tract presenting a moist, grayish, diphtheritic appearance, with interspaced areas of angry looking, beefy red tissue. The discharge was very odorous. The amazing part of the whole picture was the lack of marked discomfort on the patient's part, her only complaint being urinary frequency and some dysuria. There were moderate numbers of red blood cells and some pus cells in the catheterized specimen. Elliott treatments were continued, as indicated below:

2/ 3/32—35 minutes at 2 pounds' pressure and 125°  
 2/ 8/32—30 minutes at 2 pounds' pressure and 125°  
 2/12/32—35 minutes at 2 pounds' pressure and 125°

The burns at this time showed a marked improvement, the necrotic membrane sloughing out with very little bleeding. The vagina was packed after each treatment with vaselined gauze.

This was left in until twenty-four hours before the next treatment, then removed and a cleansing bicarbonate of soda douche given. Treatments were further continued as follows:

2/16/32—40 minutes, 2 pounds' pressure, 128° to 130°  
 2/20/32—40 minutes, 2 pounds' pressure, 128° to 130°  
 3/ 3/32—35 minutes, 2 pounds' pressure, 128° to 130°  
 3/15/32—30 minutes, 2 pounds' pressure, 128° to 130°  
 Total treatments eleven, over a period of two months.

Following the last treatment, the vagina presented a normal appearance. Not only was the slough gone, with the attendant discharge, but the pain for which she presented herself and the leucorrhea had also been completely relieved. When seen again in May, she felt completely well and had no symptoms or discharge. The vagina, by inspection and palpation, seemed normal.

CASE 2.—(E. G. W.) Mrs. E. W., twenty-eight years of age, married three years. One pregnancy, terminating in a spontaneous abortion at eighth week, two years ago.

Early in December, 1931, patient noticed an inflammation near the introitus, which became steadily worse. There was persistent pain of a throbbing nature, with an associated thick, greenish-white leucorrheal discharge, moderate terminal dysuria, frequency, and marked vulva edema.

A diagnosis of acute Bartholinitis, probably gonorrheal, was made, although repeated smears from both glands and cervix were negative for gonococci. She was given symptomatic treatment and hot wet dressings applied. Ten day bed rest and local treatment of a conservative nature alleviated pain and swelling. By December 26 the swelling was practically impalpable, but some vaginal discharge persisted. Uterus and adnexa were normal except for moderate symptomless enlargement of right ovary.

Because of the persistence of the discharge, with associated Bartholinitis, a series of Elliott treatments were begun, as follows:

Dec. 29—35 minutes at 2 pounds' pressure-distention. 128° to 130°  
 Jan. 2—40 minutes at 2 pounds' pressure-distention. 128° to 130°  
 Jan. 9—60 minutes at 2 pounds' pressure-distention. 128° to 130°  
 Jan. 14—60 minutes at 2 pounds' pressure-distention. 128° to 130°

Following the last treatment, the patient complained of soreness. Examination 5 days later showed severe burns of the upper vagina with adhesions beginning to coapt the inflamed and gray membranous surfaces. The denser adhesions were divided January 29 with the actual cautery, and Elliott treatments for 40 minutes at 120° continued, the vagina being packed after each treatment with sterile vaselined gauze. Treatments were given at four and five-day intervals.

By March 17 the mucous surfaces had entirely reformed and presented soft, smooth, pliable surfaces with no evidence of the preexisting ulcers or divided tissues.

CASE 3.—(S. A. C.) Eleanor G., aged thirty-eight, para ix. Spontaneous delivery Oct. 5, 1931, at home. Remained in bed nine or ten days; was up and about one week, when she became acutely ill. Seen in consultation Nov. 16, 1931 (forty-two days postpartum), with high fever, severe pain in left lower abdominal quadrant, persistent vomiting, chills and night sweats, rapid pulse, anxious expression, dehydration, signs of acute parametritis and pelvic peritonitis. Admitted to Margaret Hague Maternity Hospital Nov. 16, 1931. On admission temperature was 105°; pulse 100 to 120; respirations 24; urine was negative; blood: red blood cells 3,680,000; Hb 64 per cent; white blood cells 14,500. Sedimentation time eighteen minutes. Blood culture was negative.

She received two Elliott treatments daily for ten days and one daily for eleven days, a total of thirty-one treatments over a period of twenty-one days, each of sixty minutes' duration at temperatures 120° to 130°.

Patient's temperature reached normal on the ninth day after admission, and she was discharged on the twenty-first day, convalescent; pelvic signs had almost completely disappeared. The vagina and fornices felt *boggy and swollen*, indicative of rather marked local reaction to the long continued heat, but there was no evidence of ulceration or necrosis of the mucous membrane.

On Feb. 5, 1932, approximately two months after her discharge from the hospital and discontinuance of Elliott treatment, she was seen at home, complaining of lower abdominal distress and intense pain in the rectum, with rectal tenesmus. She had not had any visible menstrual discharge in the interim.

Bimanual examination showed a complete occlusion of the vagina at about its middle, with massive induration of the pelvic cellular tissue along the whole right side of the vagina. During the examination the finger penetrated the partly cicatrized occluding barrier and there was a moderately copious discharge of viscidly fluid dark blood, which is believed to have been retained menstrual blood.

Patient was referred to hospital for observation. Lipiodal injection showed only a narrow sinus connecting the upper and lower portions of the vagina. The uterine cavity was of normal contour, the uterus was pulled to the left, the right tube was partly filled, the left not at all.

The constriction was progressively dilated at several sittings, using first Hegar's uterine dilators, and then test tubes of graduated sizes.

During this time there was some mild irregular fever, which gradually subsided. The patient's subjective condition improved, and the pelvic inflammatory induration decreased. She was discharged Feb. 18, 1932.

On several subsequent office examinations the degree of dilatation secured in the hospital was maintained, and menstruation was not further interfered with. At the last report, May 13, 1932, no pelvic symptoms were complained of.

CASE 4.—(S. A. C.) Mary H., aged thirty, grav. 1. Delivered at St. Mary's Hospital Nov. 18, 1931, in O. R. P., by Scanzoni maneuver. Two days later she showed what appeared to be a grippy infection characterized by a chill, infected throat, severe frontal headache, generalized muscular pains, râles throughout chest, and elevation of temperature to 103.2°. The following day her temperature, of the remittent type, reached 105.4°; chest signs were indeterminate except for disseminated râles and there was unproductive cough. The lochia was very odorous and several clots were expelled. Her attendant still considered her infection influenzal in nature.

This course continued without significant change, the daily temperature ranging from 102.8° to 104.6° until Dec. 3, 1931, the fifteenth postpartum day, when she was first seen in consultation.

Physical findings at this time indicated an acute bilateral parametritis, with localized peritonitis. Pulmonary findings were essentially negative, which x-ray on this date con-

firmed. Two days afterward, temperature again reached  $105.4^{\circ}$ , and later on this day the first Elliott treatment was given. They were continued at intervals of twice a day, for sixty minutes' duration, at temperatures up to  $130^{\circ}$  F., for thirty-one days. During this interval patient progressed to a fairly satisfactory convalescence, the temperature becoming normal on the fifty-fifth day. She was discharged Jan. 16, 1932, on the fifty-ninth postpartum day. At this time x-ray findings in the lungs were entirely negative except for some slight diffuse increase in density of markings.

One of us saw her in her home about two weeks after her discharge from the hospital, and noting some narrowing of the vagina, warned her attendant to watch for further atresia.

She was again referred in consultation April 1, 1932, two and one-half months after the last Elliott treatment. She had not menstruated and complained of severely painful sense of pelvic tension and rectal pressure.

At about the level of the junction of the lower and middle thirds of the vagina, there was complete atresia apparently by transverse agglutination of the anterior and posterior vaginal walls. A little to the left of the midline was a tiny exfoliation of what looked like granulation tissue. A slender forceps was readily forced through the obstruction at this point, whereupon there was an immediate gush of thick brownish-red material evidently representing an old accumulation of blood. It was not foul, nor clotted. It continued to exude to a total amount of more than 500 c.c. and some discharge continued for several hours after she left the office.

At subsequent sittings the opening was gradually dilated to a diameter of 3 to 4 cm. During this period she had a normal menstruation.

In May, 1932, she removed from the locality, and no further report has been obtained.

#### SUMMARY AND COMMENT

1. Four cases are presented, of damage to the vaginal mucosa believed to be directly due to the Elliott treatment. Two had definite burns of the upper vagina, one of which showed beginning adhesions which would almost certainly have progressed to permanent atresia, if not detected and treated. Two showed complete occlusion of the vagina by cicatricial atresia undoubtedly due to original damage similar to that noted in the first two.

2. These cases are reported without prejudice to the value of the method, but with the warning that regular careful inspection of the parts should be maintained during any course of such treatments and the suggestion that the frequency and duration of the latter be regulated by the reaction of the tissues involved.

254 UNION STREET.

39 GIFFORD AVENUE.

#### ABSTRACT OF DISCUSSION

DR. F. C. HOLDEN.—We have been using the Elliott treatment in Bellevue Hospital since November, 1929, and have been very favorably impressed with the results obtained. However, it is not the value of the Elliott treatment which is under discussion at present. Approximately 10,000 treatments have been given, by three nurses, who were well trained in the technic. One slight burn occurred at a time when we had a substitute nurse. Treatments in this case were given daily, using moderate distention, and temperature of  $120^{\circ}$ , and rapid and complete healing resulted.

We think it is well to use moderate distention and a moderate degree of temperature in patients past middle life, especially where there is an atrophic condition of the vagina. In all patients, the vagina should be examined before each subsequent treatment to note the condition of the tissues. The distention used, should always be borne with comfort

by the patient, and the temperature during treatment should be raised only three-quarters of a degree per minute.

Our conclusion, based upon this large series of treatments is, that when the proper technique is used, we feel it is impossible to get a burn severe enough to cause any damage of the vaginal mucosa.

DR. H. F. GRAHAM.—We have used the treatment in about 600 cases. The worst burn was in the third treatment given by an interne before we had a trained technician, and he distended the bag to about four pounds, kept the temperature at 130° and went away in spite of the complaints of the patient, because he understood that was the way to give the treatment. In that case there was a slough about an inch and a half in diameter which took twelve or fourteen days to heal completely.

DR. S. A. COSGROVE.—Dr. Holden has touched indirectly on the purpose of presenting these cases. He has said that in his experience they have had only one or two minor burns because the treatments have been given by experts specially trained. It is not to be conceived that any method can be offered to the profession and have everybody that uses it as expert as Dr. Holden's operators are, and therein lies the value of the warning that some very unpleasant results may occur from the use of this procedure.

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## TUBAL PREGNANCY FOLLOWING UTERINE INSEMINATION\*

R. A. LIFVENDAHL, M.D., CHICAGO, ILL.

*(From the Department of Gynecology of the Post Graduate Hospital and Medical School)*

A REVIEW of the available literature for the last twelve years does not elicit a single case of tubal pregnancy following artificial insemination for the relief of sterility. That other gynecologic procedures, particularly of a diagnostic character, have been followed by pregnancy is confirmed by Rubin.<sup>1</sup> In 1929 he reported 205 cases of pregnancy out of 2000 cases in which he had done uterotubal insufflation for infertility. In 3 of these 205 cases the pregnancy was located in the fallopian tube. Since this article concerns the question of infertility the discussion is not centered about the subject of "induced" tubal pregnancy. The same author,<sup>2</sup> in another writing, regarding the most favorable time for tubal insufflation, states that there is less possibility of displacing an impregnated ovum from the uterine cavity if the patency test of the fallopian tubes is done about one week after menstruation. In our patient, uterotubal insufflation was performed, but the procedure was done some time before artificial insemination, and evidently has very little, if any, import in this case.

Untoward results have included those conditions attended with performing the Rubin test, plus the possibility of carrying infected material into the uterus, fallopian tubes, or peritoneal cavity. Before performing the procedure, the above possible complications should be kept in mind. Trauma of the endometrium can occur with the possibility of gas embolism and collapse and even death is apt to take place if the method is not used at the proper time has been sufficiently emphasized by Rubin.<sup>1</sup> Also, he has described adequately the subject of dislocation of the endometrium

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\*Presented before the Chicago Gynecological Society, December 16, 1932.

through the fallopian tubes with resultant endometriosis of the adjacent pelvic structures. Infection of the fallopian tubes and pelvic structures can occur as the result of several errors in technic or the presence of infection in the genital tract of the male or female. If a specimen is obtained from a container that is not aseptic or if infected from the vagina, the bacteria from these sources can readily produce infection along the course of the genital tract. The following case is of considerable interest because of presenting none of the above mentioned complications.

#### CASE REPORT

White patient, twenty-four years of age, entered the clinic on Jan. 10, 1931, because of a yellowish-white vaginal discharge which came from an "eroded" and cystic cervix. Linear cauterization was performed on Jan. 12, 1931, and by February 7 of the same year the treated area was healed and there was no discharge, except for a small amount of clear mucus from the cervical canal. On Jan. 12, 1931, she presented the question of sterility but was advised to wait until the cervix healed before performing any tests. She had been married in August, 1925, and one year and nine months later had an uncomplicated delivery. For two years after this they practiced coitus interruptus; but for over three years contraceptive precautions had not been taken. Menstruation began at thirteen years of age, was regular until marriage, and since had been irregular, with bleeding occurring every three to six weeks, six to seven days' duration, moderate in amount, and accompanied with moderate lower abdominal cramps. She described herself as a "spitter" in that the semen was always discharged following intercourse. Examination at this time showed a relaxed "levator sling" and a slight cystocele. A Rubin test performed on Feb. 17, 1931, showed patency of the tubes. The next day a colpoperineoplastie operation was performed. After this had firmly healed, intercourse was indulged in on an average of twice a week for a period of nine months. On Dec. 6, 1931, a one-hour old vaginal "puddle" specimen of live spermatozoa was injected into a normal appearing cervical os by means of a bulb-syringe, under moderate pressure. No coitus following uterine insemination until January 10, and she had not indulged since her last menstruation on November 23, two days following the previous menstruation, which ended on Nov. 2, 1931. Seven weeks later she had not menstruated, complained of pain and fullness of the breasts, and pain in the left lower quadrant. The latter symptom had been repeatedly present before and was regarded as being due to a spastic sigmoid. At this time the uterus was very slightly enlarged, firm throughout but colostrum was expressed from the nipples. Three weeks later she stated that she had been nauseated and vomited daily for a period of two to three weeks. The pain in the left lower quadrant had been especially severe, seventeen days after the insemination, on Dec. 23 and 25, 1931. On examination at this time (Feb. 13, 1932) the findings were the same as of seven weeks following the insemination, but in addition the body of the uterus was softer and to the left of it was a tender mass twice the size of a normal ovary. No vaginal bleeding had occurred. On Feb. 23, 1932 she acquired a "severe cold," with a temperature of 104°, and on the twenty-sixth of the same month began to bleed profusely from the vagina. Examination, three days later, showed a 3 by 5 cm. boggy and tender mass, which had been noted ten days previous. The cul-de-sac was free of any mass or exudate. Bleeding continued from the vagina until she was again seen on March 12, when the findings were the same. This period of observation was permitted because of the possibility of an aborting intrauterine pregnancy, associated with a cyst of the left ovary. The latter periodic swellings of the left ovary had been noted in her on one occasion before the insemination had been performed. Although the test for pregnancy was positive, in this case it was of no help. But since no fetal or placental tissue had been passed, laparotomy was advised.

On March 14, 1932, thirteen weeks after uterine insemination, preliminary curettage yielded a moderate amount of thin and slightly thickened endometrium of a yellow and red to purple color.

Before opening the peritoneum through the Pfannenstiel incision, small dark purple 1 to 2 cm. pieces of clots were seen through the peritoneum and the latter were also found between the loops of the ileum. Exploration of the pelvic organs revealed the following: The uterus was  $1\frac{1}{4}$  times normal size, anteverted, and moveable. The left fallopian tube was adherent to the posterior aspect of the corresponding broad ligament and ovary by moderately firm purplish adhesions that were easily freed, permitting the tube to be delivered. The distal one-half of the tube presented a fusiform intact purple colored swelling, having a diameter of 4 cm. in its ampullar portion and tapering towards the fimbriated end where its diameter was 2.3 cm. Lying in the opening of the fimbriated end of the tube enmeshed and held there by dark clotted blood was an 8 cm. long pale yellow embryo. The right fallopian tube and ovary were grossly normal. The left tube was removed.

The possibility of the pregnancy having occurred before the artificial insemination is rather remote because of the size of the embryo, the onset of clinical symptoms and findings and her inability to become pregnant before the artificial insemination had been done. The Rubin test had been done nine months before the insemination, so she should have had sufficient opportunity to become pregnant if the insufflation of the tubes had opened them. Furthermore, no findings were noted when the injection was done to indicate that the tubes had ever been closed.

That the infected cervical mucous discharge probably prohibited her from becoming pregnant previous to the cauterization of the cervix uteri is very likely. Against this is the fact that the discharge from the cervical canal had been grossly normal for a period of eight months before insemination was resorted to.

#### ABSTRACT OF DISCUSSION

DR. MARK T. GOLDSTINE.—I have noted five cases of very severe pelvic infection following insemination, one requiring the removal of a large abscess of the ovary. We feel this is a rather dangerous thing to do.

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#### REPORT OF A CASE OF TERATOMA OF THE UTERUS\*

JULIUS E. LACKNER, M.D., AND LEON KROHN, M.D., CHICAGO, ILL.

*(From the Departments of Gynecology and Pathology of the Michael Reese Hospital)*

TERATOMAS are defined by Ewing<sup>1</sup> as a group of tumors composed of recognizable tissues and complex organs derived from more than one germ layer. Although teratomas have a distinct predilection for the sex glands, their occurrence in the uterus is an extreme rarity. A review of the literature revealed only very few cases of teratoma of the uterus, the majority of which are of questionable authenticity. Robert Meyer<sup>2</sup> emphasizes the fact that one must make a diagnosis of termatoma of the uterus with extreme caution.

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\*Read before the Chicago Gynecological Society, November 18, 1932.



The majority of tumors described as teratomas of the uterus were originally teratomas of the ovary which, because of inflammation, became adherent to the uterus. Eventually they perforated the wall of the uterus and became intrauterine tumors.

However, two authentic cases were reported recently. Mann described a teratoma embryonale situated in the left horn of the uterus which contained derivatives of the three germ layers. Hellendall's case was an intramural teratoma of the corpus uteri which perforated into the uterine cavity and discharged hair through the vagina. There are many other cases on record which cannot be accepted as true teratomas of the uterus.

#### REPORT OF CASE

The purpose of this communication is to report a teratoma of the uterus. The tumor was attached to the internal os and projected through the cervical canal (Fig. 1) in the form of a polypoid growth. The essential details of the case are as follows:

Mrs. H. H., aged thirty-four, entered Michael Reese Hospital Dec. 7, 1931, with the complaint of vaginal bleeding of fourteen weeks' duration. She had been married for sixteen years, and had two normal fullterm deliveries, the first in 1916, and the second in 1918. Her menstrual periods were very irregular, the interval varying from fourteen to sixty days, the duration from two to eight days, and the amount of flow from 2 to 20 pads. During the latter part of May, 1931, she had a seven day period. Since then she had been flowing almost continuously, using a pad each day. On August 26, 1931, the vaginal bleeding increased and resembled a normal period. The patient suffered from cramps which were drawing in character and occurred every two or three minutes. She expelled a mass from the vagina which she described as a hard lump  $2\frac{1}{2}$  inches long. The bleeding subsided and recurred two weeks later continuing from the middle of September to the time of her entrance into the hospital on December 7, 1931.

The gynecologic examination made Dec. 7, 1931, was as follows: The atrium was multiparous. The cervix was badly lacerated and soft. The external os admitted a finger tip. The corpus was slightly enlarged, anteфлекed, freely movable, and not sensitive. The adnexa were normal. A diagnosis of incomplete abortion was made and on the following day a dilatation and curettage were performed. The tissue obtained was diagnosed as endometrial polyp with endometrial hyperplasia. The patient made an uneventful recovery and was discharged from the hospital Dec. 13, 1931.

On Feb. 23, 1932, the patient was admitted to the service of the senior author because of continued vaginal bleeding since her discharge from the hospital. Vaginal examination at this time revealed a pedunculated tumor about 4 cm. in diameter, protruding from a dilated cervix. The surface of the tumor was irregular and the consistency of the tumor was soft. The corpus and adnexa were negative.

A biopsy was performed on Feb. 27, 1932. Since the exact nature of the tumor was not established by frozen section, it was deemed advisable to remove the uterus. A vaginal hysterectomy was done. The ovaries and tubes were normal and were left intact. The patient made an uneventful recovery and was discharged on March 10, 1932.

The pathologic report was as follows:

The specimen consisted of a symmetrical, previously opened uterus 12 by 5 by 4 cm. in its greatest diameter (Fig. 1). The myometrium averaged 1.5 cm. in thickness. The endometrium averaged 1 mm. in thickness; it was granular and hemorrhagically discolored. A 1 cm. circumscribed, firm, fibrillar intramural nodule typical of a myofibroma was present in the fundus. Attached to the cervical mucosa, about 3 cm. above the external os, was an irregular, nodular grey-white mass measuring 4 cm. in

diameter. It was of firm consistency but contained several cysts measuring up to 1 cm. in diameter. These cysts were filled with a viscid opalescent fluid. The tumor projected into and dilated the cervical canal. The tumor was easily movable. The area of attachment was roughly circular and measured 1.5 cm. in diameter.



Fig. 1.—Gross specimen of opened uterus illustrating position of tumor.

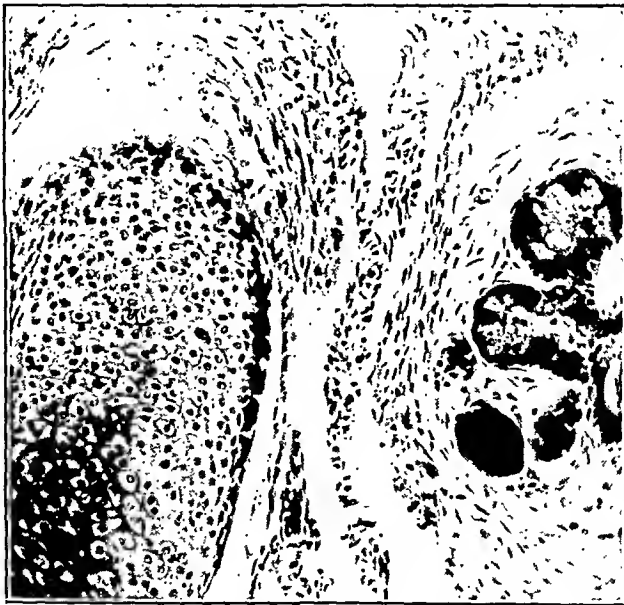


Fig. 2.—Detail of cartilage and mucoserous glands. ( $\times 100$ .)

Histologic examination: The wall of the cervix at the point of attachment of the nodular mass was only partially covered by epithelium. On other portions of the tumor the epithelium was absent and replaced by fatty tissue and small bundles of smooth muscle fibers. At the lower portion of the tumor the epithelium consisted of

cervical lining cells. The nodular mass itself is made up of a great variety of epithelial and connective tissue structures. In various sections, cartilage (Fig. 2), smooth muscle, myxomatous tissue, fatty tissue, ganglion cells, peripheral nerve fibers, squamous epithelium with sebaceous glands, hair follicles, occasional sweat glands

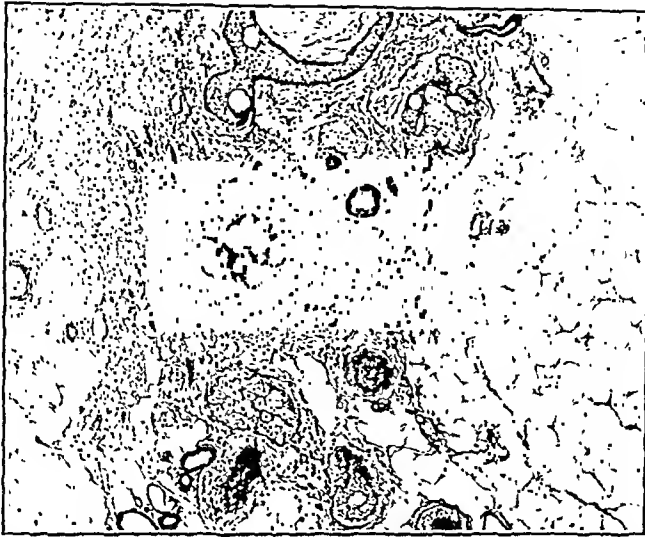


Fig. 3.—Haphazard groupings of squamous epithelium, hair follicles, sebaceous glands, and atrophic sweat gland structures, surrounded by adipose and fibrous tissue. ( $\times 60$ .)



Fig. 4.—Lower power view of dermoid structures shown in Fig. 3, demonstrating contiguity with epithelial structures of intestinal type. ( $\times 20$ .)

(Figs. 3 and 4), pseudostratified columnar ciliated epithelium resembling the nasal mucosa, and epithelium of the bronchial type (Fig. 5) are identified. In addition, there is a tendency toward an organoid arrangement of tissue elements (Figs. 5 and 6). Structures which can be identified as intestines are found (Fig. 6). In these, the

epithelium contains many goblet cells and form crypts identical with the crypts of Lieberkühn. In the depths of these crypts, typical Paneth cells are found in large numbers. Beneath there is abundant lymphoid tissue reproducing the structures of the lymphoid follicles of the intestines. Cartilage and cylindrical epithelial structures are found in arrangements suggesting very strongly bronchial structures (Fig. 5). In short, derivatives of all germ layers are found; organoid intestinal and respiratory



Fig. 5.—Ciliated columnar epithelium, cartilage and mucoserous glands reproducing the aspect of a bronchial wall. (x250.)



Fig. 6.—Structures recognizable as small intestine, with longitudinal and circular muscle bundles, lymphoid follicles and typical intestinal mucosa. (x40.)

structures representing entoderm; cartilage, smooth muscle and fat tissue representing mesoderm; and skin with its derivatives as well as ganglion cells and peripheral nerve fibers representing ectoderm. In all sections, careful search fails to reveal the presence of any structures whose origin can be attributed to fetal membranes. The diagnosis of the tumor was teratoma of the uterus with attachment to the internal os, projecting in the form of a polypoid structure through the cervical canal. There was also a myofibroma of the uterus.

## DISCUSSION

This case is reported because of the rarity of true teratoma of the uterus and the difficulty in diagnosing these tumors. The tumor described represents derivatives of the three germ layers and is attached at the internal os. The presence of two normal ovaries and two normal tubes exclude the possibility of a teratoma of the ovary or tube becoming adherent to the uterine wall, perforating it, and thus becoming an intrauterine teratoma.

The question naturally arises as to whether the case reported here is a true teratoma, or whether it is a part of an embryo transplanted to the region of the internal os after an incomplete abortion. We must also consider the possibility of a cervical pregnancy or even a twin parasitic growth. It is impossible to make a definite diagnosis in spite of the fact that the histologic picture of this tumor answers all the qualifications included in the definition of a teratoma. It is conceivable that the patient was pregnant and aborted incompletely. Some of the remaining tissues of the embryo may have been implanted in the cervix with subsequent tumor formation. In favor of such an assumption is the fact that at the time the patient was first seen a dilatation and curettage were performed and the tumor was not detected. When the patient returned to the hospital two and one-half months later, a tumor was found protruding through the cervical canal. This rapidity of growth is probably more suggestive of implantation of tissue from a pregnancy than of a true teratoma. It is probable that at the time the patient was first curetted, the tumor was present and was overlooked. On the other hand, there is no proof that the patient was pregnant. The scrapings from the uterine cavity showed no evidence of a pregnancy but were diagnosed as endometrial polyp with endometrial hyperplasia. The fact that no decidual tissue was found does not rule out a pregnancy, because the decidual tissue could have been absorbed in the period which elapsed from the time the possible abortion occurred until the curettement was performed. One cannot assume from the history alone that a pregnancy had existed, particularly since the menstrual periods were always irregular.

After due consideration of these possibilities, we feel that the case here presented is a true teratoma of the uterus. Almost any case diagnosed as teratoma of the uterus is open to some of the criticism ventured here. We are aware of the fact that one must make a diagnosis of teratoma of the uterus only when every other possibility is ruled out.

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104 SOUTH MICHIGAN AVENUE.

#### ABSTRACT OF DISCUSSION

DR. OTTO SAPHIR.—One very important question presents itself, namely: is this a true teratoma or does the tumor consist of portions of a fetus implanted in the region of the internal os? The history revealed an abortion in August which clinically was not diagnosed until December when the patient entered the hospital for the first time. At this time the patient was curetted but the tumor was not recognized. As a matter of fact the tumor was not discovered until two and one-half months later at the final operation.

The history of an abortion is in favor of the tumor being part of a fetus. Also the fact that the tumor was not seen at the curettage is in this favor. The histologic findings of whole organs such as intestinal wall with mucosa, submucosa and muscularis, and trachea with mucosa, submucosa, mucous glands and cartilage, speak more or less against teratoma. The relative age of the fetus could very well be six months which would correspond exactly to the history.

In favor of this being a teratoma is the location of the tumor, its pedunculated appearance, and probably the absence of testicular and ovarian structures. But if this is a teratoma, it must be conceded that the tumor was missed at the curettage, because I do not believe that a teratoma could have attained this size in two and one-half months.

What do we mean by teratoma? Most of the textbooks define a teratoma as a tumor which consists of representatives of three germinal layers which are present in disorderly fashion. Such a definition would very well fit this tumor with the possible exception that we are not dealing just with representatives of three germinal layers, but also with formations of organs.

It is possible that during the curettage a portion of a fetus was displaced and implanted in the region of the internal os.

DR. LESLIE BRAINERD AREY.—Looking objectively at a slide shows one thing, while reading the history into the same slide will sometimes tell another story. So far as the microscopic preparations go, I see no reason how one could avoid calling the present specimen a teratoma. Certainly the organoid arrangements, the appearance of poorly organized bronchial-like structure, the intestine, and so on, are the things that are repeatedly described in teratoma in other locations where fetal implantation would seemingly be excluded. In what are called teratomatous masses, of course, we are probably including a variety of things because there are all gradations between twins of the asymmetrical type and fetus in fetu, as well as things of quite different nature, like giant cysts of primitive streak origin, teratomatous masses inside the body of the type shown here. Whether one is always discussing a homogeneous type or is sometimes including under the same pathology different categories of things is often questionable.

As the result of all the newer knowledge we are still just where we were in the interpretation of teratomas. Furthermore, there seems to be no immediate escape from this dilemma without the development of some line of attack which will produce new and convincing information as to what its pathogenesis really is.

DR. N. S. HEANEY.—I do not think too much weight should be given to the fact that no tumor was discovered at the time of the curettage. Clinical evidences would

seem to point to the fact that the tumor was present at that time. A curettement was performed and the symptoms for which she was operated upon continued without abatement and at a later time, when operated upon, the tumor was found. I believe the tumor was there at the time of the first operation. We see this frequently in cases of intrauterine pedunculated fibroids where a curettage is done and subsequently the uterus gives birth to the fibroid.

DR. JOSEPH L. BAER.—A negative point that might have some bearing on the decision is the thought that if fetal implantation were the basis of this tumor, then fetal implants ought to be found very much more frequently than they are. In the vast number of abortions that take place in this and other communities, many of which are incomplete, in many of which fetal structures are left, and in many of which the uterine mucosa is traumatized, there should be a greater frequency of fetal implantations than we actually see or hear reported. The extreme rarity of this lesion may add to the argument that the specimen is a true teratoma.

DR. FREDERICK FALLS.—Regarding the rapidity of growth in teratoma, a patient came under my observation about three years ago at Cook County. This patient had a hysterectomy performed by Dr. Schmitz for a fibroid. He left one ovary after a supracervical hysterectomy. Within six months the woman returned to the County Hospital with a tumor about as large as a baseball. I operated and removed a teratoma arising in the ovary which Dr. Schmitz had left. That tumor was at least 10 cm. across, so it seems to me that this tumor could easily have grown in the length of time between the two operations. I should like to ask Dr. Lackner if any of the tumor cells showed evidence of malignancy.

DR. KROHN (closing).—Since the histogenesis of teratomas is still a matter of conjecture, and the subject of teratomas is so broad, only a few of the more important issues involved in this case can be discussed at this time. Dr. Saphir favors the diagnosis of fetal implantation because, in the first place, he assumes that the patient was pregnant and aborted incompletely in August, 1931, and secondly, because of the presences of organoid intestinal and respiratory structures in the microscopic sections. In answer to the first assumption, there is no evidence in the history of the existence of a pregnancy. As Dr. Lackner has already stated, the patient's menstrual periods were always irregular. At the time the curettage was performed, no products of a pre-existing pregnancy were found. The tumor was probably present at this time and overlooked. The instrumental dilatation of the cervix could have been sufficient to aid the passage of the pedunculated tumor through the cervical canal so that when the patient returned to the hospital two and one-half months later, it protruded through the external os. No sharp line of demarcation can be drawn between the histologic picture of teratomas and fetal implantations. The presence of organoid intestinal and respiratory structures do not speak against the diagnosis of teratoma if we are to accept the definition of these tumors given by Ewing; that they are a group of tumors composed of recognizable tissues and complex organs derived from more than one germ layer. MacCullum describes teratomas as rudimentary organ-like masses of tissues mingled together in an unsuccessful attempt to form a fetus. In teratomas there is a mixture of fetal tissues in disorderly arrangement. In fetal implantations, one would expect to find organs in nearly normal relations. Lexer collected seventeen cases of fetal implantations in the abdomen in which he found rudimentary limbs, organs, and well formed membranes and umbilical cords. These were not found in the case presented here. On the other hand, numerous teratomas have been found to contain intestinal organs. In a personal communication with Dr. Jaffé, he expressed the opinion that this tumor is a teratoma or tridermoma after having studied the case and having examined the sections. He believed that the tumor arose from the wall of the uterus since both ovaries and tubes were normal and there were no adhesions about

the uterus. Because of all these facts mentioned, we believe this tumor to be a teratoma of the uterus and that fetal implantation is a remote possibility.

In answer to Dr. Fall's question, there was no evidence of malignancy in the microscopic sections and also there was no invasion of the tumor into the uterus.

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## GUMMAS OF THE URINARY BLADDER

WALTER E. LEVY, M.D., AND CARL J. TRIPOLI, M.D., NEW ORLEANS, LA.

*(From the Department of Gynecology and Department of Pathology, Charity Hospital)*

**S**YPHILIS, manifesting itself in the tertiary stage (gummas) and involving the genitourinary tract, especially the urinary bladder, is of interest, not only as regards its rarity, but also as regards the difficulties in making an accurate diagnosis. The salient facts upon which a diagnosis is usually made are: a history of syphilis, the positive complement fixation test, and the cystoscopic findings.

A rather extensive review of the literature has not revealed a similar case, wherein it was possible to make such a detailed microscopic examination as in this one. In view of this, the following case is believed to be of sufficient interest to warrant reporting.

The patient, a colored female of twenty years, was admitted to Charity Hospital on March 27, 1931, with a history of pain in the lower abdomen, and a leucorrheal discharge. She had had the discharge for the past year, and this and the pain date back to an abortion about that time. Her past history, other than this, was irrelevant, and her general physical examination was negative. She did not complain of any pain or burning upon urination, or any urinary frequency.

Vaginal examination revealed a cervix which was slightly lacerated, and the seat of a mild endocervicitis. The uterus was anteflexed and fixed. There was tenderness in both tuboovarian regions, and on the right side, an ovarian cyst, about the size of an orange, approximately 8 cm., could be palpated.

The Wassermann reaction was strongly positive. Two injections of neoarsphenamine, 0.4 gm. each were given at an interval of seven days, prior to operation.

The urine, a voided specimen, examined before operation, revealed nothing of note except for an occasional pus cell and a few epithelial cells. There were no red blood cells present. The total white blood cell count was 13,400 c.mm., and the differential count showed a slight relative and absolute neutrophilic increase. The patient's temperature was normal the entire time before the operation.

The preoperative diagnosis was, lacerated cervix, chronic salpingitis, and right ovarian cyst; tertiary syphilis.

The patient was operated upon on April 6, 1931, under ether anesthesia. The abdomen was opened in the mid-line between the umbilicus and the symphysis pubis. An ovarian cyst, about 8 cm. in size, on a pedicle, was found on the right side, and was easily removed. Microscopic examination revealed a simple polycystic oophoritis. The tubes showed slight thickening but were not removed. The left ovary was normal. The bladder on the left side was markedly thickened and had a flat tumor mass in its wall. The mass was about 5 cm. in diameter and about 1 cm. in thickness, pinkish grey in color, and adherent to the left half of the corpus uteri. In attempting to free this by blunt dissection, the mass was penetrated, and a considerable quantity of necrotic material escaped. Fearing that the bladder might have been entered, a glass catheter was passed by an assistant through the urethra, and in turn presented at the puncture wound. It was decided to explore further, and the peritoneum to the side of the bladder and uterus was opened, and on careful examination, this necrotic mass was found to extend down to the left iliac vessels.

The wall of the bladder adjacent to the necrotic mass was hard and friable. The



rent in the bladder was closed with interrupted linen sutures. The opening was further sealed by suturing the fundus of the uterus over it, and then the left round ligament was in turn brought over this suture line. A piece of rubber tissue and a cigarette drain were put in, and the abdomen was routinely closed. An indwelling catheter was inserted into the bladder. The patient left the operating table in fairly good condition.

On the third postoperative day, the patient started to have a temperature which ranged from 100.5° to 102° for the next three weeks. During this time she appeared dull and apathetic.

About one week following the operation, she developed a suprapubic urinary fistula.

After about the third week, perhaps as a result of intensive syphilitic treatment, the patient improved a bit.

On May 5, 1931, the patient was cystoscoped (Dr. Beacham). The report of the cystoscopist was: "Cystoscope introduced easily. Bladder contracted with pressure deformity on the right side. On the left side, posteriorly is a fistulous tract that drains

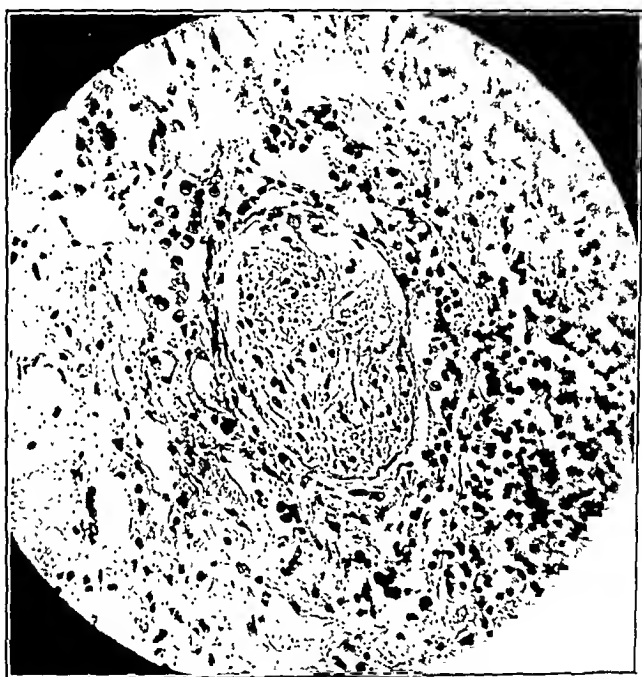


Fig. 1.—High power 60x. Illustrating endarteritis with thrombosis and perivascular lymphocytic infiltration.

through a suprapubic fistula. From the history, operation and examination, the condition is one of sloughing gumma of the bladder."

The remainder of the course was one of a steady decline, and on June 7, the patient died; two months after the operation.

Only a partial necropsy was possible, by means of opening the subumbilical laparotomy incision. There was a diffuse filmo-purulent generalized peritonitis, most marked in the pelvis. The urinary bladder and tubes and ovaries were matted together in the inflammatory exudate. The bladder was contracted down, and upon its removal was opened. A small amount of purulent urine was present. The mucosa was markedly inflamed and pinkish in color. Diffusely distributed over the bladder mucosa, were whitish plaques, irregular in contour and ranging from 2 mm. to 1 cm. in diameter. In the upper right cornu of the bladder there was a tumor mass covered over by acute inflammatory exudate. On opening the mass, it was firm in consistency, yellowish-white in color with a central area of necrosis.

Microscopic examination revealed the blood vessels markedly thickened, accompanied by endarteritis with thrombosis and perivascular lymphocytic infiltration. There was a diffused slight fibrosis with lymphocytic infiltration and a few neutrophilic leucocytes scattered. Here and there small areas of necrosis with an occasional multinucleated giant cell was present. (Figs. 1 and 2.)

It is singular, in reviewing the literature, how really little is said concerning gumma of the bladder. Keyes<sup>1</sup> does not mention it in his textbook; neither does Morton.<sup>2</sup> B. C. Corbus,<sup>3</sup> writing in Cabot's "Modern Urology," makes the statement that "Syphilitic lesions of the bladder are scarcely known," and most works on urology and syphilology, fail to make mention of the subject. Lowsley and Kerwin,<sup>4</sup> state that for many years it was thought that the bladder never partook of infection resulting from syphilitic invasion. Duroux of Paris (quoted by Lowsley and Kerwin) in 1913, gave the first extensive review, and collected 26 cases of tertiary vesical syphilis. Karl Franz Graeff<sup>5</sup> in his doctor's thesis, gives perhaps the most comprehensive study of bladder syphilis.

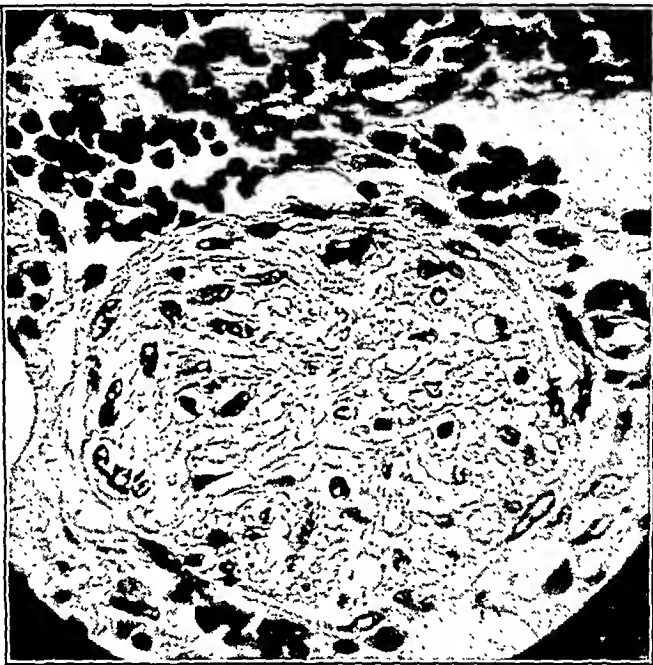


Fig. 2.—Same as Fig. 1. 97 $\times$ .

The consensus of opinion concerning the diagnosis of gumma of the bladder seems to be as follows: A history of syphilis; a positive Wassermann reaction; urinary symptoms, chief of which is hematuria; and a cystoscopic examination.

Duroux and Levy-Bing<sup>6</sup> in 1912, made routine cystoscopic examinations of the bladders of many syphilitic patients, and they say that syphilitic ulcerations of the bladder can exist without producing any symptoms referable to the urinary tract. Such was the fact in our case—no hematuria or frequency of urination.

Graeff<sup>5</sup> says that syphilis of the bladder can exist either as a cystitis, as ulcerations, or as gummas, and also makes the statement that gummas can exist a long time without giving symptoms.

Only two articles are available in the American literature, one by M. Morris,<sup>7</sup> and another by S. W. Schapiro.<sup>8</sup> In neither of these cases were there any microscopic reports; the diagnosis being based on the history, the cystoscopic findings, the symptoms, and the therapeutic test. Schapiro's case also had a positive Wassermann.

Gautier<sup>9</sup> also reports a case, and gives a lengthy discussion of the clinical features. There are no microscopic reports.

Alvarez Colodrero<sup>10</sup> reports two cases with symptoms like the previous ones, but gives no microscopic reports.

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207 PHYSICIANS AND SURGEONS BUILDING.

## REPORT OF A CASE OF MYOMECTOMY FOR AN INTERSTITIAL FIBROID COMPLICATED BY A VERY EARLY PREGNANCY\*

HIRAM N. VINEBERG, M.D., NEW YORK, N. Y.

A YOUNG woman, aged twenty-eight, married eighteen months, consulted me in November, 1929. Briefly her history was as follows: Menstruated at thirteen, four weekly type, four to five days' duration, moderate in amount and without much pain. She had never been pregnant. In June of the same year she was operated upon presumably for appendicitis, the surgeon finding only what was probably a normal appendix. He lengthened the incision upwards and downwards so as to make a thorough exploration. This revealed an enlarged uterus, corresponding to the gravid organ at about ten weeks, due to an interstitial fibroid. The growth involved the uterus in such a way that he deemed anything short of a hysterectomy was at all feasible. Not having obtained the consent for so radical a procedure, he closed the abdomen after having removed the appendix.

The pain in the back from which she had been suffering continued and before seeing me, she had consulted a very prominent gynecologist who advised an operation but would not give much promise of being able to do anything but a hysterectomy. I found a condition as above described, the uterus now corresponding to about the twelfth week of pregnancy. While unable to give her a definite promise of conserving the uterus, I expressed the opinion that I thought a myomectomy could be done and in any case, I would make a very determined effort to do so. On January 13, 1930, at Mount Sinai Hospital, I opened the abdomen in the median line and delivered the uterus. At first sight it did not appear as if a conservative operation could be done. The growth occupied the entire anterior wall and it was difficult to discern the fundal part. On close inspection it was made out as a slight projection on the upper posterior surface of the growth. The adnexa were normal in appearance, the left one being stretched over the growth so that the isthmus seemed to be part of it. My assistants were very positive it would not be possible to do a myomectomy. I decided, however, to make the attempt. I incised the peritoneum over the lower third of the growth and carried this in a circular fashion to the extent found necessary. With the handle of the scalpel and the fingers I enucleated it from below upwards. There then remained only the posterior wall and a narrow strip of anterior wall on either side. At the bottom of the wound was a narrow

\*Read at a meeting of the New York Obstetrical Society, November 8, 1932.

slit extending from the fundus to the internal os. Through this the endometrium protruded slightly and I was struck by its marked purplish color and apparent thickness. This I attributed to the premenstrual change, the patient having menstruated three weeks before (Dec. 20 to 25). I coaptated the edges of the anterior wall with great care, taking pains to avoid the endometrium. The resulting uterus resembled the infantile organ in shape and size excepting it was longer. The patient made an afebrile recovery with primary union of the abdominal wound. But she felt poorly, had no appetite, was more or less nauseated and felt faint from time to time. On the fourth day after the operation there occurred a slight blood discharge, continuing for three or four days, which was looked upon as the menstrual period. The patient left the hospital January 26, two weeks after the operation.

On February 11, two weeks later (four weeks after the operation), she came to the office and stated that she still felt weak and had had several fainting spells, and that on one occasion she passed from the vagina a mass of reddish color and about the size of a hen's egg, evidently a blood clot. March 4 she came again and stated that she had not menstruated as yet. She was positive that the time of the last sexual intercourse was on January 11, two days prior to the operation and that none had taken place since. I found the uterus soft and enlarged to the size of the gravid organ at about eight or nine weeks. Thinking there might be a retention of blood, due to constriction of the internal os as a result of the operation, I cautiously passed a sound beyond the internal os and there being no escape of blood, it dawned upon me that the patient undoubtedly was pregnant at the time of the operation and that she was then probably in the first or second week of gestation. The question then arose whether or not the pregnancy should be allowed to continue. I decided not to interfere, and was upheld in this opinion by my colleague and friend Dr. I. C. Rubin. I advised the patient to place herself under the service of the Woman's Hospital for prenatal care and delivery. The pregnancy apparently progressed normally. She thought she felt life on April 21. On September 24 I found the fundus within a finger's width from the ensiform and the head low in the pelvis. I advised her to seek admission to the hospital at once for induction of labor. This advice was followed and she was admitted September 26. Castor oil and quinine were given but had no effect. The obstetrician-in-chief telephoned that he deemed a cesarean section should be done, as he feared the uterus would rupture when labor pains set in. He was kind enough, however, to be guided by my opinion to the contrary. The patient was, therefore, discharged the next day and instructed to return as soon as labor pains set in. Until then the movements of the fetus were very marked but apparently they ceased a day or two later for she no longer felt them.

Two weeks later pains set in spontaneously and she was readmitted to the Hospital, October 11, where she delivered herself, after a labor of twenty-one hours, of a macerated fetus weighing 5 pounds, 13 ounces. The puerperium was uneventful. On March 9, 1932, the patient was delivered again at the Woman's Hospital at full term of a male child, weighing  $7\frac{1}{4}$  pounds. The labor was moderately difficult, lasting thirteen hours and necessitating low forceps. The puerperium was normal. In October I personally examined her in my office. The uterus was then of normal size and in proper position.

The special features of the above case are:

1. The continuance of the early pregnancy despite the extensive operation on the uterus.
2. The difficulty at the beginning of arriving at the correct diagnosis.
3. The justification of the assumption that the uterine scar would safely withstand the strain of labor.

The last normal menstruation occurred December 20 to 25. The first coitus after this was on the night of December 27, and had been repeated about twice a week until January 11, i. e., two days prior to the operation. Assuming even, therefore, that conception had taken place at the first cohabitation, the ovum at the time of the operation could not have been older than seventeen days. That it had reached the uterine cavity

before that may be safely assumed from the fact that the tubes had been carefully inspected and nothing abnormal noted, excepting that the left one was stretched over the growth and was very much thinner in consequence, and also from the appearance of the exposed endometrium.

1185 PARK AVENUE.

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## COMPLETE PLACENTAL DETACHMENT WITH APOPLEXY OF THE UTERUS REQUIRING HYSTERECTOMY\*

DR. M. L. LEVENTHAL, CHICAGO, ILL.

THIS patient was a primipara, thirty years old, who was admitted to the Michael Reese Hospital at 4:45 P.M. on December 4 on the obstetric service of Dr. Lackner. At 2 P.M., one-half hour after a normal bowel movement, she had severe pain in the abdomen associated with dizziness on standing. Her last menstrual period had occurred on March 18. No fetal movements were felt following the onset of the pain.

In her past history there were two induced abortions in 1924 and 1927. The patient was last seen at the clinic one week before admission at which time her blood pressure was 110/80, the urine was negative, and she was feeling fine.

On admission the patient had a blood pressure of 140/90; the urine showed 3-plus albumin with a few granular casts; temperature was 99.4°, pulse 76, respiration 22. The color of the skin and mucous membranes was good. The patient felt quite well except for some abdominal pain. The red count on admission was 3,750,000 and hemoglobin was 75 per cent. Blood chemistry was normal. The uterus was the size of a full term pregnancy and was in a state of constant contraction. The cervix was effaced with 2 cm. dilatation.

Since the patient's condition was good it was decided to use conservative treatment. On the following morning, having been quite well during the night, the patient began to appear very pale and restless. Pulse was 84, temperature 99.8, red count 2,170,000 and hemoglobin 50 per cent. The fundus was somewhat hard and of a woody consistency. Cesarean section was performed at this time with the diagnosis of bleeding into the uterus. The abdomen on opening contained about 16 ounces of free serous fluid. The uterus was very hard and markedly hemorrhagic and presented the appearance of a large twisted ovarian cyst. A low cervical cesarean section was performed and a macerated fetus delivered. The uterine cavity was filled with black blood clots. The uterine wall was markedly infiltrated with blood. Because of the marked bleeding and the apparently hopeless condition of the uterus and the condition of the patient, it was decided to do a supracervical hysterectomy. The operation was followed by an intravenous infusion of 500 c.c. of whole blood. The patient left the operating room in good condition. Three days after operation her red count was 1,810,000, with a hemoglobin of 50 per cent. Another transfusion of 500 c.c. of whole blood was given for the anemia and the patient left the hospital eleven days after operation in good condition.

### ABSTRACT OF DISCUSSION

DR. RUDOLPH W. HOLMES.—I am glad Dr. Leventhal did not say he had a case of abruptio placentae because the term has been objectionable to me since I coined the term *ablatio placentae* in 1901. *Abruptio* implies that the condition has a violent, sudden onset which is only true in something like 10 per cent of cases: in

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\*Presented at a meeting of the Chicago Gynecological Society, December 16, 1932.

the remainder the onset may be insidious, or the symptoms so masked that for a period one may justifiably be in doubt as to the diagnosis: the literature is replete with records supplied by expert obstetricians wherein this statement is substantiated. This implication carries a gross error just as accidental hemorrhage, originated by Rigby, gives the erroneous conclusion that some catastrophe was responsible for its genesis.

Dr. Leventhal accentuated the fact that he took the blood pressure reading—this is a vitally important observation, especially in instances of uteroplacental apoplexy, in spite of the fact that in Preston Willson's collation of cases, some 67, there were only about a half dozen where the pressure reading was recorded; and of these they ranged from normal to over 200 systolic: we need a cumulative study again to determine the true interpretation and value of pressure readings: my own surmise is that pressure readings will eventually contribute to a differentiation of the nontoxic types from Couvelaire's toxic apoplexy.

The next thing I would stress is the vital necessity of having repeated hemoglobin tests with careful blood counts—not only of the "reds" but I believe equally important it is that the leucocytes should be enumerated. I called attention to this in connection with toxic apoplexy in my paper published in 1923, for in my case the uterine and placental blood spaces were teeming with polymorphonuclear leucocytes.

As regards routine hysterectomy for uteroplacental apoplexy, I believe Whitridge Williams erred in maintaining that every case should be hysterectomized, basing his recommendation upon his two personal cases. Certain cases must have the uterus removed if we would place the woman in the minimum of jeopardy: We must concede this question has not been effectively answered. At the present moment I would surmise that we should perform hysterectomy when the uterus feels like water-soaked leather, there is no bleeding from the cut surfaces, and no attempt at contraction even after strenuous endeavors to secure muscular action—by massage, hot packs, pituitrin, ergot. Conversely, if the uterine wall is living, evidenced by contractility and bleeding from the cut surfaces, then it may wisely determine conservation of the uterus. I am still firmly convinced that ablatio may be the result of some pathologic state foreign to toxemia, may be due to an accident, and may be due to a definite toxemia as suggested by Couvelaire. Based on my own personal experience from 23 cases of ablatio I would decry any attempt to demand that *all* must be delivered by cesarean section, and I would lend my voice in objection to a routine hysterectomy. In my series one only was delivered by an abdominal operation, she was the basis of my paper in 1923, and she survived. Three died, 13 per cent; one succumbed from the hemorrhage, ante- and postpartum hemorrhage: one died in eclampsia some twelve hours postpartum; the twenty-third case entered the hospital with double ablatio retinae, toxic apoplexy surmised from her general condition, a severe cardiovascular break, dying "from the heart" approximately forty-eight hours postpartum. How many of these were true instances of toxic apoplexy is a conjecture, for, as yet, conclusive proof of placental apoplexy only is forthcoming from an inspection of the uterus. However, conceding that ablatio invariably is due to toxemia then the fact that 19 of the 22 which were delivered per vaginam recovered is proof positive that hysterectomy is not an essential curative detail. In Willson's collection hysterectomy was fatal in 47.6 per cent (21 cases, 10 deaths) while in patients in whom the uterus was left but 19 per cent (21 cases, 4 deaths) succumbed.

# REPORT OF A CASE IN WHICH A STEM PESSARY HAD BEEN EMBEDDED FOR FIFTEEN YEARS IN THE UTERUS\*

FRED L. ADAIR, M.D., CHICAGO, ILL.

THE uterus from a woman, fifty-one years old, contained a number of small fibroids and a stem pessary, which according to the patient's statement, had been in the uterus fifteen years. It is a rather peculiarly shaped pessary. She had relatively few symptoms except menorrhagia and metrorrhagia for one year. She had one profuse hemorrhage lasting forty-eight hours and accompanied by the passage of a good many clots. The findings were a somewhat asymmetrically shaped uterus, rather firm and hard with multiple fibromyomas, some laceration of the cervix and a foreign body in the uterus. We could feel and hear a metallic click on the passage of a sound into the uterus. The pelvic floor was also relaxed. The uterus measured 13 by 9 by 8 cm. with the cavity 11 cm. deep. The greatest thickness of the uterine wall was 4 cm. and the endometrium was 1 cm. thick.

There have been three other cases of this type in the Chicago Lying-in Hospital. One case, Dr. Serbin attended after the patient developed sepsis; she died. Non-hemolytic streptococci and staphylococci were recovered from the peritoneal fluid. Another case was of a woman, twenty-one years old, who had a pessary inserted following an induced abortion in 1929. Later she developed a rather severe pelvic inflammatory condition and was operated upon two and one-half years later at our clinic. There was another case in which a pessary had been inserted in the uterus and the women later conceived. At the time of delivery the pessary was embedded in the placenta.

## DISCUSSION

DR. ARTHUR H. CURTIS.—Dr. Jones and I had more than a half dozen of these pessary cases at St. Luke's Hospital. In one patient a pessary had been inserted, and fearing she would become pregnant a second one was inserted, forcing the first pessary upward and through the fundus of the uterus. We also had a very interesting experience many years ago with a patient admitted with a very serious pelvic peritonitis. She insisted that she was not pregnant and that nothing had been done in an instrumental way. There were pelvic inflammatory masses, two abscesses almost as large as a child's head. She finally recovered and left the hospital. The masses disappeared completely. Two years later she returned to the hospital with a recurrence of the pelvic peritonitis. She again denied pregnancy or attempted abortion, but finally admitted that in order to avoid pregnancy she had had a stem pessary inserted before the first attack of pelvic peritonitis and a year and a half after that attack she had a second stem inserted with a recurrence of the peritonitis.

DR. N. S. HEANEY.—I removed the uterus in a case of this sort not suspecting the presence of a stem pessary until after the uterus was excised. The patient had had depleting hemorrhages over a long period of time, was forty years of age, and medical treatment had failed to control the bleeding. She had had the pessary inserted a number of years before and had forgotten all about the incident. We did not have an x-ray made in advance.

DR. O. S. PAVLIK.—At the Northwestern University Dispensary a woman came in complaining of severe pain and a foul bloody discharge. On examination we found a pessary with a ring, like the one reported by Dr. Adair. The question was whether or not we could pull it out or would have to resort to surgery. Finally after some effort we pulled it out. Its removal was followed by a discharge of foul material.

Some years ago we had a case in which we could see on x-ray examination a foreign body resembling the rubber tip of a dropper. On opening the uterus we found a pessary that had been there six or seven years.

\*Presented at a meeting of the Chicago Gynecological Society, November 18, 1932.

# THE VIABILITY OF FRAGMENTS OF MENSTRUAL ENDOMETRIUM

SAMUEL H. GEIST, M.D., NEW YORK, N. Y.

(From the Gynecological Service, Mount Sinai Hospital)

IT HAS been shown that the menstrual blood, escaping from the uterus, contains fragments of uterine mucosa. The presence of these fragments has been utilized as a means of differentiating menstrual blood from other hemorrhagic vaginal discharges.

From the morphologic characteristics of the individual cells and from their tinctorial reactions, it was assumed that these cells were viable. Sampson, who has so well described the clinical picture which has been termed endometriosis, has offered as a possible explanation the retrograde transportation of menstrual fragments through the tube with implantation and growth in the peritoneal cavity. To substantiate this theory one must prove that the menstrual fragments can pass through the tube and that they are viable.

While it has been shown by Jacobson and others that the transplanted endometrium can grow, it has not been demonstrated that fragments desquamated during the menstrual period can implant themselves and grow. We were able to prove that the fragments desquamated during menstruation were small enough to pass through the tubal lumen and also that they were composed of living cells. A small amount of the menstrual blood collected in a test tube as it escapes through the cervix is drawn through a capillary pipette, the lumen which is one-third of that of the interstitial portion of the normal tube. From this aspirated fluid smears are made and stained supravitaly. This technic is as follows:

*Stock Solutions.*—(1) Saturated solution of neutral red in 95 per cent absolute alcohol ( $P_H$  7). (2) Saturated solution of Janis green B. in 95 per cent absolute alcohol ( $P_H$  7).

*Directions.*—A. Mix twelve drops of Solution 1 with forty drops of Solution 2. Glass slides must be absolutely clean and neutral in reaction. Cover glass slides with film of Solution A. When dry place a drop of blood on the slide and cover immediately with a cover slip and seal with vaseline.

The appearance of stained granules, greenish to brownish in color within the cytoplasm of these endometrial cells demonstrates that they are living and remain alive for at least one hour after they escape from the cervix. The fact that these fragments are living and that they can be aspirated through a pipette whose lumen is only one-third of that of the normal tube, demonstrates that the Sampson theory is a possible one, in so far as these tiny fragments can pass through the fallopian tube and be deposited on the peritoneum.

It is evident also that the desquamation of mucosa is not due to a local necrosis, for if this were so, the necrotic fragments would not remain alive. This fact makes it necessary to assume some other hypothesis to explain the bleeding of normal menstruation.

I wish to thank Dr. Nathan Rosenthal, Hematologist to the Mount Sinai Hospital for his help and suggestions.

55 EAST WASHINGTON STREET.



## PLACENTA PREVIA WITH TWIN PREGNANCY\*

JAMES S. RAUDENBUSH, M.D., PHILADELPHIA, PA.

ON APRIL 2, 1932, I was called to see Mrs. C. S., forty years, para viii. Being apparently overdue, having slight painless bleeding for over two weeks and now a few stray pains, she was sent to the Northeastern Hospital. The suspicion of placenta previa ("marginal" type) was verified and a high classic cesarean section performed. The placenta was attached to the front and right of the uterine wall. A strong, active, and crying girl was extracted by the feet. Another sac was discovered and its placenta was low on the left and posterior surface and "marginally" separated, and from this was removed, feet first, a cold, quiet, and anemic boy. Both were cephalic presentations. On account of her age, pelvic conditions, insanitary environments, and economic conditions, I sterilized her and removed the right tube and ovary (laboratory: "chronic salpingitis and oophoritis with fibrosis and cystic degeneration of the ovary"). Venaclysis during operation, hypodermoclysis afterwards, but she never consented to a blood transfusion. No postoperative vomiting nor distention, wound healed perfectly, recovery was uneventful. Twenty cubic centimeters of blood was injected into the boy's buttocks and a month later his blood showed, hemoglobin 75 per cent, erythrocytes 4,420,000 and leucocytes 8,400. All three recovered.

The case I am reporting is my first placenta previa complicated by a twin pregnancy, and I have been able to find only one such instance where a cesarean section was done, viz.: by Jardine of Glasgow in 1908. All other reported cases were delivered by the vaginal route by various methods.

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## GAUZE PAD REMOVED FROM THE ABDOMEN†

CAREY CULBERTSON, M.D., CHICAGO, ILL.

THIS specimen (Fig. 1) was removed from a colored patient, aged thirty-seven years. She had been operated upon in Arkansas in 1922 for what was said to be pus tubes. At that time the appendix was also removed. In 1923 the same doctor operated upon her again for adhesions. Since that time she continued to have pain in the lower abdomen. At times she had more than the usual pains, and there was evidence of partial intestinal obstruction. In 1927 the patient went to a hospital in Chicago and was operated upon for fecal impaction. After this operation she continued to have pain in the lower abdomen. Another operation was advised at the same hospital but the patient refused.

She came to me in May of this year complaining of pain in the lower abdomen which was intermittent. She had a temperature of 100° on May 9; on the eleventh of May she had no fever. I did not operate until June 7.

Examination of this patient showed her to be well nourished, rather robust. There was a mass in the abdomen about 15 cm. above the symphysis and there was some tympany present. There was moderate resistance over this mass which was not so hard as a fibroid and appeared to be inflammatory. On vaginal examination we had the impression that the uterus was involved. The patient had never been pregnant. The cervix was normal.

On May 21 the white blood cell count was 10,400; urine normal. She had two median scars in the midline which showed rather diffuse herniation, and one through the right rectus muscle.

When I began opening the abdomen I found the ileum adherent to the subcutaneous fat. Dissection was not easy but the bowel was finally freed. Beneath the mass in

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\*Read at a meeting of the Obstetrical Society of Philadelphia, November 3, 1932.

†Presented to the Chicago Gynecological Society, June 17, 1932.

the lower abdomen there was a uterus containing two rather small fibroids. There was no right appendage. The cecum was fixed between the uterus and the right pelvic wall and apparently in good condition. On the left side there was a cystic ovary about 9 cm. in diameter with a tube that was thickened. This was all adherent and could not be delivered without rupturing. A subtotal hysterectomy and enucleation of the left appendage was done. The loops of the ileum were freed from the adhesions which were gossamer-like, fine and delicate. In removing the ileum from the right abdominal wall I detected the odor of escaping intestinal material and found a tiny hole in one of the loops of ileum, which was repaired by a purse-string suture. The operation being completed, apparently, I put my hand into the upper abdomen and felt a mass which seemed to be rather free. It was very hard, irregular, suggesting a malignancy of the bowel. I enlarged the incision upwards and pulled this mass down. It proved to be a dilated portion of the small bowel, distended to a diameter of 8 cm., and had a hard mass in it. The omentum was above it and free. Because the lumen of the bowel was distended, I made an incision and was able to extract from it this



Fig. 1.

specimen which proved to be a piece of gauze. The incision in the bowel was repaired and the abdomen closed, with a cigarette drain inserted through a stab wound made toward the right.

The patient has made a satisfactory recovery without any distention whatever.

This piece of gauze apparently represents an ordinary laparotomy pack, and it was free in the lumen of the bowel. The distended bowel wall was somewhat thickened, but no changes were observed in the mucosa.

185 NORTH WABASH AVENUE.

## ABDOMINAL PREGNANCY COMPLICATED BY ECLAMPSIA\*

EDWARD ALLEN, M.D., CHICAGO, ILL.

A COLORED primipara, aged twenty-one, was admitted to the Central Free Dispensary Nov. 11, 1928. Last menstrual period occurred on May 7, 1928. At that time nothing unusual was found on examination by the attending physician except a strongly positive Wassermann, and she was referred to the Dermatological Department for treatment. The blood pressure at this examination was 110/60 and the urine clear.

The externe was called to see the patient in her home on account of pains in the abdomen on Dec. 2, 1928. He referred her to the hospital for further examination as

\*Presented at a meeting of the Chicago Gynecological Society, June 17, 1932.

a suspect abdominal pregnancy. This was confirmed by x-ray and vaginal examination. The period of gestation was estimated at just short of seven months. It was decided to keep her under close observation until the fetus was definitely viable and then deliver her by abdominal section.

On December 4 a notation was made that the nurse who called to see her was unable to obtain a specimen of urine. However, on December 8 one was obtained which was normal and the blood pressure stood at 118/60.

In the afternoon of December 24 the husband called and said his wife had had a fit. She was transferred immediately to the hospital. When we saw her one hour later she had had a second convulsion and was in the midst of a third typical eclamptic seizure. The systolic pressure at this time was 154 and the urine contained 3 mm. of albumin. The heart tones were 142, regular, and heard best in the midline about three fingerbreadths above the navel.

She was prepared at once for laparotomy and the abdomen opened by midline incision. There was an immediate escape of a large amount of amniotic fluid containing large pieces of fibrin. The membranes were in shreds so that the fetus could plainly be seen lying in transverse position just beneath the diaphragm with the head directed to the left side of the mother. The infant cried lustily and spontaneously. Birth weight 4 pounds 4 ounces. It lived eight hours after delivery.

The placenta was attached to the left tubal fimbria and bowel. The cord surface presented immediately beneath the laparotomy opening. Gentle efforts at exploration caused some bleeding, so they were stopped, the cord cut close and the abdomen closed in the usual manner, leaving the placenta in place.

The patient was given 500 c.c. of glucose and normal salt intravenously before she left the operating table. She rested quietly for two hours when another typical convulsion occurred. This was followed one hour later by still another. Morphine sulphate, grain one-fourth had been given hypodermically following the first postpartum convulsion.

The temperature varied between normal and 100.8° until the sixth day following operation. At this time it rose to 101.4° and remained elevated between 100 and 104 the remaining twenty-six days that the patient was in the hospital. During the pyrexia the patient developed a severe psychosis which the Neurological Service seemed to think was on a toxic basis. The patient was transferred to the Elgin Hospital for the insane. Three weeks after admittance the upper end of the abdominal incision opened slightly and a large amount of material identified as necrotic placenta by microscopic examination was discharged. The temperature dropped to normal rapidly and she was dismissed as cured ten days later.

Vaginal examination three months later revealed a normal pelvis with the uterus freely movable and menstruating normally. Blood pressure at this time was 112/68. The urine was normal and the Wassermann negative.

## A SPECULUM FOR USE IN CERVICAL CAUTERIZATION\*

EDWARD FRANCIS McLAUGHLIN, M.D., PHILADELPHIA, PA.

THE primary function of a vaginal speculum is to give proper exposure of the parts. In cauterization work a second thing is desirable, protection. In developing this speculum, I tried to combine the two essentials. The instrument is in effect a two-bladed speculum with side walls on each blade. The upper blade in cross-section looks like an inverted "U" and fits into the upright "U" of the lower blade when closed. Two sizes have been made. The larger one has a spread of  $2\frac{1}{2}$  inches at its end, with no space between upper and lower blades, the smaller about  $1\frac{1}{2}$  inches.

Insertion of the larger speculum is accomplished by depressing the perineum with the index and middle fingers separated, and then directly inserting the instrument.

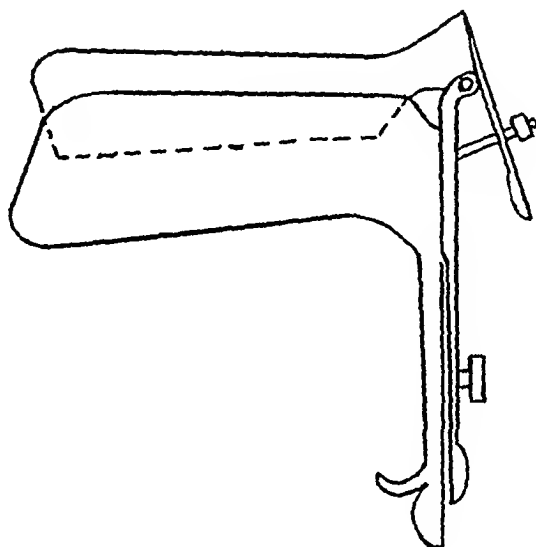


Fig. 1.—A new vaginal speculum for cauterization treatment of the cervix.

When inserted the cervix can be brought into view and adjusted into position as with a Graves' speculum. This cannot be done as well with a tubular speculum. In withdrawing a gentle rotary movement is made as the blades are allowed to collapse and the speculum removed.

The larger speculum has been used in nulliparous marital vaginas without discomfort, but is most applicable to multiparous ones. The smaller type is inserted sidewise as is an ordinary Graves' speculum and withdrawn as is the larger one. It is applicable in those cases where the larger one is unsuitable.

It may be used:

1. In multiparae where the relaxed vaginal walls "fold in" between the blades of ordinary specula.
2. In nulliparous patients where the use of a speculum is a new experience and where a burn would prove greatly annoying.
3. In nervous and mentally deficient persons where sudden movements on the table might cause burning.

\*Presented at a meeting of the Obstetrical Society of Philadelphia, October 6, 1932.

4. In teaching cauterization to students where a slip of the hand would ordinarily mean a burn.

5. Another use has been suggested and is being tried with some additions to the present speculum, namely, direct x-ray treatment to malignant cervixes.

4116 NORTH BROAD STREET.

## ASPERGILLUS FUMIGATUS VAGINITIS\*

MARK T. GOLDSTINE, M.D., CHICAGO, ILL.

**A** REVIEW of the literature on leucorrhea secondary to *Aspergillus fumigatus* shows no reported cases.

This patient presented herself for examination December, 1931. She was thirty-nine years old, married eighteen years, sterile, with negative menstrual history. Her health had been good. The present complaint was nonirritating, odorless leucorrhea of several years' duration, and an intermittent pruritis vulvae.



Fig. 1.—*Aspergillus Fumigatus*.

Pelvic examination revealed a slightly red and irritated vulva with a grayish discharge which was also present in the vagina. This discharge was microscopically negative. On the posterior vaginal wall and the posterior cervical fornix were numerous grayish white nodules about 2 to 4 mm. in diameter. These were firmly adherent and on removal left a raw surface. Histologic examination of four of these small nodules revealed the presence of a fungus growth readily identified as *Aspergillus fumigatus* growing in necrotic tissue.

25 EAST WASHINGTON STREET.

\*Presented at a meeting of the Chicago Gynecological Society, June 17, 1932.

# Society Transactions

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## NEW YORK OBSTETRICAL SOCIETY

*STATED MEETING, OCTOBER 11, 1932*

Injuries to the Vagina Resulting From the Elliott Treatment. DR. SAMUEL A. COSGROVE AND DR. EDWARD G. WATERS, JERSEY CITY, N. J. (For original article see page 729.)

Some End Results of 1,114 Cases of Prolonged Labor at the Manhattan Maternity and Dispensary. DR. ROBERT LOWRIE.

Diabetes and Pregnancy. DR. J. RONSHEIM, BROOKLYN, N. Y. (For original article see page 710.)

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## NEW YORK OBSTETRICAL SOCIETY

*MEETING OF NOVEMBER 8, 1932*

The following papers were presented:

Report of a Case of Myomectomy for an Interstitial Fibroid Complicated by a Very Early Pregnancy. DR. H. N. VINEBERG. (See page 746.)

An Experimental Study of the Effects of Intravenous Injections of Hypertonic Glucose Solution (50 per cent) on the Circulation of the Cat. DR. V. P. MAZZOLA AND MARCUS A. TORREY. (See page 643.)

Conization of the Uterine Cervix. DR. M. N. HYAMS. (See page 653.)

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## NEW YORK OBSTETRICAL SOCIETY

*MEETING OF DECEMBER 13, 1932*

The following papers were presented:

A Clinical Study of Avertin in Gynecology and Obstetrics. DR. G. GORDON BEMIS. (By invitation.) (See page 677.)

The Mechanism and Management of the Third Stage of Labor. DR. M. L. BRANDT. (See page 662.)

Injury to the Urinary Bladder Following Irradiation of the Uterus. DR. A. L. DEAN, JR. (By invitation.) (See page 667.)

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## OBSTETRICAL SOCIETY OF PHILADELPHIA

*MEETING OF OCTOBER 6, 1932*

The following papers were presented:

A Speculum for Use in Cervical Cauterization. DR. E. F. McLAUGHLIN. (See page 755.)

Hyperthyroidism Associated With Pregnancy. DR. F. A. BOTHE. (See page 628.)

Concerning Death of the Fetus in Pregnancy. DR. J. S. LAWRENCE. (See page 633.)

Observations Upon Adynamic Ileus. DRS. E. A. SCHUMANN AND J. V. MISSETT. (To be published in a subsequent issue.)

## OBSTETRICAL SOCIETY OF PHILADELPHIA

MEETING OF NOVEMBER 3, 1932

The following papers were presented:

Placenta Previa With Twin Pregnancy. DR. J. S. RAUDENBUSH. (See page 752.)

Döderlein's Bacillus in the Treatment of Vaginitis. DRS. R. W. MOHLER AND C. P. BROWN. (See page 718.)

Primary Carcinoma of Bartholin's Gland. DR. W. B. HARER. (See page 714.)

Pelvic Sympathectomy for Pain in Carcinoma of the Cervix. DR. C. A. BEHNEY. (See page 687.)

Aschheim-Zondek Pregnancy Test, Friedman Modification. DRS. B. MANN, D. MERANZE, AND L. GOLUB. (See page 723.)

## CHICAGO GYNECOLOGICAL SOCIETY

MEETING OF JUNE 17, 1932

The following case reports and papers were presented:

Abdominal Pregnancy Complicated by Eclampsia. DR. E. ALLEN. (See page 753.)

Gauze Pad Removed From the Abdomen. DR. C. CULBERTSON. (See page 752.)

Aspergillus Fumigatus Vaginitis. DR. M. T. GOLDSTINE. (See page 756.)

The Irregularity of the Menstrual Function. DR. E. ALLEN. (See page 705.)

The Volumetric Determination of Amniotic Fluid With Congo Red. DR. W. J. DIECKMANN AND DR. M. E. DAVIS. (See page 623.)

Hydrocephalus and Cyclocephalus. DR. W. B. SERBIN. (Abstract follows.)

Mrs. F. R., aged thirty-five, gravida one, was admitted to Wesley Hospital in labor on February 22, 1932, apparently at term. After approximately seventy-two hours the cervix was not more than 8 cm. dilated, although completely effaced. Because of irregular fetal heart tones and maternal exhaustion, immediate delivery was decided upon. Two Dührssen's incisions, each about 2 cm. long, were made and cervical dilatation was artificially completed. The head was in occiput left transverse position and its lowest portion was 1 cm. below the ischial spines. It was manually rotated through an arc of 45° and the forceps applied as in occiput left anterior. With a single trial traction the forceps slipped and it was immediately decided that the case was not one for forceps extraction. Further careful examination revealed large anterior and posterior fontanelles and widely separated sutures; the left ear could not be palpated. A diagnosis of hydrocephalus was made and delivery completed by craniotomy and cleidotomy. In addition to the hydrocephalus the baby was a cyclops monster, sub-variety cyclocephalus with rudimentary eye and central single eyelid upper and lower; cleft upper lip in midline (not a true harelip); partial cleft palate; bilateral pes varus; hypoplasia of left auricula and absence of left external acoustic meatus; absence of external nose; aplasia of cerebrum, the latter being represented by two soft fibrous masses; absence of cribriform plate of ethmoid; absence of olfactory lobe and olfactory nerves; single apparently fibrous nerve branching off from optic chiasma; absence of oculomotor nerve; hypoplasia of hypophysis, thyroid and adrenal glands.

Thymus, heart, lungs, gastrointestinal tract and urogenital organs present and apparently normal.

Microscopically, liver well marked; myelopoietic tissue around larger blood vessels;

numerous small foci of erythropoiesis in liver sinusoids; distinct evidence of retarded development. Thyroid fibrotic; increase in fibrous tissue. Stroma, some colloid in a number of acini. Lung: aeration incomplete; myeloid foci about some of the larger blood vessels; retarded development. Pancreas: fat and fibrous tissue; lobules surrounded by fibrous tissue stroma. Adrenal: medulla normal, cortex underdeveloped. Thymus and spleen normal.

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## CHICAGO GYNECOLOGICAL SOCIETY

*MEETING OF NOVEMBER 18, 1932*

The following papers were read:

**Report of a Case in Which a Stem Pessary Had Been Embedded for Fifteen Years in the Uterus.** DR. FRED L. ADAIR. (See page 750.)

**Report of a Case of Teratoma of the Uterus With Fetal Implantation.** DR. J. E. LACKNER AND DR. L. KROHN. (See page 735.)

**Psychogenic Factors in Functional Female Disorders.** DR. K. HORNEY. (See page 694.)

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## CHICAGO GYNECOLOGICAL SOCIETY

*MEETING OF DECEMBER 16, 1932*

The following papers were presented:

**Complete Placental Detachment With Apoplexy of the Uterus Requiring Hysterectomy.** DR. M. L. LEVENTHAL. (See page 748.)

**Tubal Pregnancy Following Uterine Insemination.** DR. R. A. LIFVENDAHL. (See page 733.)

**The Relation of Season and Constitutional Type to Menstruation.** DR. L. ARNOLD. (Abstract follows.)

The amount of material lost during menstruation, the duration of menses in hours, were accurately determined upon 317 normal women in a large factory over a period of two years. There was a shortening of the intermenstrual period during March (spring season) and also during September (fall season). The average duration of menstruation was found to be sixty-five hours. The average loss for this group was 43.4 gm. The seasonal changes in the time, duration, and amount of material lost in grams were illustrated by graphs and charts. The duration in hours of the menses was shorter during the warm months of the year. The amount of material lost in grams was not altered. The grams lost per hour of menstruation was therefore greater during the summer than during the winter months. The work is being continued, hemoglobin determinations are being made and bacteriologic studies of used pads are being carried out.

**Biochemical Alterations and Their Relations to the Menstrual Cycle.** DR. W. F. PETERSEN. (Abstract follows.)

In a study of the normal female by means of daily blood chemical and clinical examinations over long periods of time, the rhythmic alterations due to endocrine and seasonal effects were studied. The influence of alterations of the general chemical status with the menstrual period and its influence on the effect of sex hormones and on the rhythmic character of the menstrual flow were likewise observed.



# Department of Reviews and Abstracts

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CONDUCTED BY HUGO EHRENFEST, M.D., ASSOCIATE EDITOR

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## Collective Review

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### ACUTE (EXTRAGENITAL) INFECTIONS IN PREGNANCY, LABOR, AND THE PUERPERIUM\*

J. P. GREENHILL, M.D., CHICAGO, ILL.

**A**CUTE infections which complicate pregnancy, labor and the puerperium usually have more evil consequences than when they occur in nonpregnant individuals.

Both maternal and fetal mortality are usually high. Part of the increased maternal death rate is attributable to the stress and strain of abortion or labor which often decrease the patient's resistance considerably. This is certainly true when the lungs are involved. Furthermore, some diseases lead directly to puerperal sepsis.

In most acute infections, labor pains are not disturbed and the third stage of labor is usually normal. Occasionally postpartum hemorrhage occurs. The puerperium in most cases is not unusual. Only when the specific organism stimulates the pyogenic bacteria in the genital tract so that secondary infections occur, is there increased susceptibility to puerperal complications. Involution usually progresses normally.

Not only may the acute infections disturb pregnancy, labor, and the puerperium but the reverse also holds true. Many infections run a much more serious course during pregnancy than otherwise, and the gravity is usually increased when pregnancy is interrupted as a result of the infection. The increase in mortality and morbidity is due to the sudden change in metabolism, the blood loss and exhaustion which occur during labor. Since interruption of gestation does not help but in most cases makes matters distinctly worse, *artificial interruption of pregnancy is contraindicated.*

In a large proportion of cases, abortion occurs. Many authorities believe that the high fever which is associated with acute infections is responsible for the large number of abortions. Runge showed that among rabbits, the fetuses die in utero if the mothers are subjected to high temperatures. He also proved that heat stimuli when applied to the uterus of a rabbit produced tetanic contractions of that organ. Runge concluded that while heat was not the sole cause of fetal death, it was an important factor. Hence, it is necessary to reduce the high temperature in pregnant women. Seitz on the other hand, does not believe that fever is a cause of fetal death. He considers the toxemia produced by the bacteria as the important etiologic factor, because these toxins, like other protein products, stimulate uterine activity. Seitz is of the opinion that both the fever and the uterine contractions are due to bacterial toxins. In pneumonia additional factors stimulate the uterus to contract, namely the lack of oxygen and the excess of carbon dioxide.

In some instances pathologic changes in the placenta are responsible for the interruption of gestation. These changes are due to bacteria or toxins in the maternal blood. In many cases the living or dead fetus does not show any changes which indicate the transfer of the disease from mother to offspring. In others, however, the placental barrier is not so effective and bacteria gain access to the fetus.

An important question is the transfer of immunity from the mother to the fetus. Ehrlich proved experimentally in mice that immunity in the father is not transmitted to the fetus; but immunity induced in the mother before pregnancy supervened is

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transmitted to the fetus. This immunity persists for about three months. The short duration indicates that the immunity is not an active but a passive one and is due to the transfer of antibodies from the maternal to the fetal organism. Hence neither sperm nor ova can transmit acquired immunity. The temporary immunity is transmitted first through the placenta at the time of labor and after that through the maternal milk.

In human beings, Pfaundler found that immune bodies may be transferred through the placenta, regardless of whether the placenta is intact or not. However, this mode of transmission is unusual and not physiologic. The transfer of immune bodies through human milk has also been proved but this route is too inconstant to be useful for the prophylaxis and treatment of infections.

Infections which begin during the puerperium are generally not more serious than in nonpregnant individuals. The question of nursing is important when an infection is present. In certain diseases it is permissible to allow the baby to nurse but in others it is dangerous for the child or the mother or both. Where the child has a high resistance against an infection as in measles and scarlet fever, nursing may be permitted. However, where the infant has a low resistance as in typhoid it should be separated from its mother as soon as possible. Sometimes the serious condition of the mother prohibits nursing regardless of the susceptibility of the child.

#### INFLUENZA

Pregnant women seem to have a distinct predisposition to grippe because this disease especially attacks young healthy individuals. The chief characteristic of the epidemic in 1918 was severe pulmonary complications especially pneumonia. The latter occurred particularly in pregnant women, and it progressed rapidly due to the physiologic hyperventilation which takes place during gestation, even in the early months. (Hyperventilation which is normally associated with pregnancy is the result of the normal acidosis of pregnancy.)

If a pregnant woman develops pneumonia during an attack of influenza, the danger is greatly increased should labor set in. The reasons for this are the unfavorable effects of strong respiratory movements and the changes in intrathoracic pressure which are always present during the second stage of labor. Absolute rest which is essential in pneumonia is not obtainable during labor. Furthermore after labor is over, the intra-abdominal pressure suddenly decreases and the diaphragm descends. This causes the lower portions of the lungs to increase their activity, and they may aspirate inflammatory products from diseased portions of the lungs. Likewise unavoidable changes in the circulatory apparatus during labor have a bad effect on pneumonia.

Harris by means of a questionnaire obtained information concerning 1,350 cases of influenza among pregnant women during the 1918 epidemic. About one-half of all the patients developed pneumonia and of these about 50 per cent died, giving a gross mortality of 27 per cent. The susceptibility to pneumonia was about the same for each month of pregnancy but the mortality was higher (60 per cent) during the last three months. Bland found a death rate of 49 per cent for his series. Ottow reported a mortality of 55 per cent for pregnant women with influenza as contrasted with 4.5 per cent for nonpregnant individuals. Schmitz obtained the following interesting information: The mortality among men was 23.5 per cent, among nonpregnant women it was 12.5 per cent, and among pregnant woman it was 45.9 per cent. The latter author found a mortality of 43.9 per cent for all cases of influenza occurring among pregnant women reported by six German investigators. Litwak reported a series of 61 cases of grippe observed during an epidemic in Leningrad in 1927 and 1928 but only two women died.

During attacks of influenza in pregnant women the gestation is interrupted spontaneously in about 35 to 60 per cent of all the cases. Most of the interruptions take place during the later months, especially near term. When pneumonia complicates grippe, the termination of pregnancy is much more frequent than otherwise. Thus in Harris' series, among 626 cases uncomplicated by pneumonia, pregnancy was interrupted in 26 per cent, where as in the 585 cases complicated by pneumonia, the incidence was 52 per cent. In 38 per cent of the fatal cases, the patients died without interference with pregnancy. In Litwak's series of 61 cases only 28 (46 per cent) of the pregnancies continued to term.

When pregnancy is interrupted the maternal mortality is distinctly higher than when the gestation is unmolested. Thus in Harris' series among 743 patients in whom pregnancy was not interrupted the mortality was 16 per cent, whereas among 468 women in whom the uterus emptied its contents, the death rate was 41 per cent. If only the pneumonia cases are considered, we find that among 383 cases in which pregnancy

continued there was a mortality of 41 per cent, while among 395 cases in which pregnancy was interrupted the death rate was 63 per cent.

It was found that in the mild cases of influenza the fetus was not affected but in the severe cases many children died especially during labor. It was not decided whether the cause in these cases was excessive heat due to fever, lack of oxygen due to cyanosis of the mother, changes in the circulatory apparatus, or intrauterine infection. Some infants died of grippal pneumonia as a result of placental infection probably because the decidua is a good focus for puerperal infection.

Labor is usually rapid in grippe and the uterine contractions are not painful. There are generally no disturbances in the third stage but bleeding may occur in the puerperium. During the delivery it is hazardous to use a general anesthetic, hence local anesthesia should be employed when narcosis is necessary.

After labor any pulmonary complication which may be present becomes worse so that the mortality among these patients is very high during the first few days postpartum. If, however, grippe sets in for the first time during the puerperium, the results are no worse than for nonpregnant women.

It is remarkable that puerperal sepsis is not common after influenza because the latter is frequently associated with streptococcal infections. However, a few cases of sepsis have been reported. If grippe begins in the puerperium it may be difficult to differentiate it from puerperal sepsis but in favor of grippe are negative findings in the genitalia, the tendency to pulmonary complications, a slow pulse in relation to a high temperature, and absence of hyperleucocytosis.

The children of patients with grippe are always in great danger. The fetal mortality varies between 20 and 45 per cent and this is essentially due to the early interruption of pregnancy. Infants may show diseases at birth which are grippal in origin such as bronchopneumonia, pleurisy, and peritonitis. Abt reported a case of influenza in a newborn infant.

The treatment of influenza during pregnancy is the same as in nonpregnant individuals. Pregnancy should never be interrupted artificially and if there are signs of impending abortion, an attempt should be made to prevent this by absolute rest in bed and morphine. All patients should be strictly isolated. De Lee found that absolute rest in bed, in a warm but well ventilated room was the greatest single factor in preventing bronchopneumonia from which the majority of women died. The rest in bed should be continued for ten days after the temperature becomes normal.

The mother may nurse her baby if she is not too ill but she should cover her nose and mouth while the baby is at the breast. Baer and Reis found that breast infections showed a direct increase in sequence to the waves of influenza, hence special precautions should be taken of the nipples and breasts in patients with grippe. However, such prophylaxis will prevent only a small number of breast infections because most of them are hematogenous in origin.

#### PNEUMONIA

Schmitt found that among 35,000 obstetric cases in Munich, pneumonia occurred 44 times or 0.13 per cent, hence this complication is infrequent. Jurgensen observed that 2.4 per cent of all cases of pneumonia are complicated by pregnancy. The more advanced the pregnancy when pneumonia sets in the greater the risk, and the greatest danger exists at the time of labor. Termination of labor does not help the pulmonary affliction.

Pregnancy is interrupted spontaneously in about two-thirds of all the patients with pneumonia. The further advanced the pregnancy, the more frequently is gestation terminated. The most likely cause of fetal death is toxemia, but there probably are other factors such as fever and excessive carbon dioxide in the blood. Pneumococci can pass through the placenta to the fetus but this does not frequently occur. Many children are born alive and remain healthy.

Labor, the puerperium, and lactation are usually not affected by pneumonia.

The treatment of pneumonia during pregnancy is the same as for nonpregnant women. Labor should not be induced because the prognosis then becomes worse. Vinay collected cases which showed a maternal mortality of 68 per cent when pregnancy was interrupted and only 15 per cent when it continued undisturbed. If premature labor occurs, delivery should be accomplished as quickly as possible. The second stage can usually be eliminated by the use of forceps. Local anesthesia should be used when an anesthetic is necessary because a general anesthetic nearly always adds to the mother's risk.

If pneumonia sets in after delivery it may sometimes be difficult to differentiate it from metastatic pulmonary disease.

## SCARLET FEVER

Scarlet fever is rare among pregnant women. Stolz in 1913 could collect only 20 cases from the literature. Schmidt who reviewed all the scarlet fever cases at the Wiener Infektions Spital during the forty years prior to 1925 found 10 additional cases. At the Chicago Lying-in Hospital, among almost 35,000 patients only three cases were observed. Devraigne, Baize and Mayer reported six cases which were seen during two epidemics of scarlet fever at the Lariboisière Maternity. One of the cases occurred after an abortion and the others after full term labor. Olshausen who reviewed the literature, believes the small number of cases observed during gestation is due to the immunity of pregnant women against scarlet fever. De Lee knows of many instances where labor occurred in the same room with children suffering from scarlet fever and he has seen no trouble arise from it.

Pregnancy is frequently interrupted, especially in the stage of eruption and less frequently in the desquamation stage. In Schmidt's ten cases, however, there were only three interruptions. In the remaining seven cases the pregnancies and labors were normal.

Puerperal scarlet fever is interesting because it is difficult to distinguish from the scarlatinal form of puerperal sepsis. In favor of scarlatina is the typical skin eruption with subsequent desquamation and eosinophilia in the blood. Jurgensen and others insist that a true epidemic of scarlet fever among puerperal women has never been observed. They say the cases so reported were nearly always septic infections with a scarlatiniform skin eruption. This opinion is also shared by Stookey and Downs who maintain that scarlet fever occurring in the puerperium is puerperal infection with a streptococcus whose exotoxin is capable of producing an erythematous eruption. Adults are generally protected against true scarlet fever and this applies to pregnant women as well. However, many authorities disagree with Jurgensen, Stookey and Downs, and believe that true scarlet fever does occur in puerperal patients. In some cases there is a very long incubation period but this is due to the tenacity of the scarlet fever organism which remains latent during pregnancy and only shows its pathogenicity during the puerperium. Posch reports an epidemic of six cases of scarlet fever which occurred in the Innsbruck Maternity at the same time there was an epidemic of scarlet fever in that city. All of these patients had the virus of the disease in them before they entered the clinic and all but one recovered. Posch maintains that scarlet fever in the puerperium differs from the usual type seen in adults. There is usually mild, or absence of, anginal symptoms, a short incubation period and beginning of exanthem. The portal of entry is usually puerperal wounds, and thus the puerperal woman is in greater danger than others. DeLavergne and Fruhinsholz agree with Posch that there is a strictly puerperal form of scarlet fever. They say that Durand reported a series of 140 cases of scarlet fever in which the disease showed itself during pregnancy 6 times, immediately after labor in 8, during the first or second day postpartum in 61, on the third day in 27, from the fourth to the eighth day in 22, and after the eighth day in 16. They also mention the epidemic reported by Theveny where all eleven cases broke out between the third and fifth day postpartum.

In most cases of scarlatina, the puerperium is undisturbed and the lochia normal. Aside from mild tenderness of the uterus there are no pathologic changes in the pelvic organs. The mortality from puerperal scarlet fever has decreased considerably during the last few years. Olshausen reported a mortality of 48 per cent for the cases he collected in the literature before 1895, while Gocht in 1894 reported a death rate of only 8.7 per cent and Schmidt, in 1925, found a mortality of 12.2 per cent.

In many cases the disease is transmitted to the fetus in utero; but usually the newborn is immune and does not contract scarlet fever even if it nurses its mother.

Pregnant women should not take care of children who have scarlet fever, and they should be isolated from such children if possible. If it appears likely that a woman in labor has been exposed to scarlatina or that she may have the disease, no vaginal examinations or operations should be undertaken unless they are absolutely necessary. This is to avoid a possible secondary infection. When an epidemic of scarlet fever appears there is an increase in the incidence of puerperal fever because both diseases are due to the streptococcus.

The treatment of scarlet fever during pregnancy is the same as for nonpregnant women.

It is well known that scarlet fever confers immunity against a subsequent attack. Adair and Tiber believe that an attack of scarlet fever in childhood confers some immunity upon women so that these women have less tendency to develop that type of sepsis which is due to the streptococcus. In a large series of private and charity patients, they found that the patients who had had scarlet fever in childhood had a lower

incidence of fever in the puerperium than those who did not have this disease previously. Furthermore, among the ten fatal cases with known streptococcus infections, not one gave a history of having had scarlet fever before. Adair and Tiber point out that it is possible the streptococcus toxin may afford us an index of the susceptibility of the patient to streptococcus infections. It is also likely that the patient's immunity to streptococcus infection could be built up when this seems to be indicated in susceptible persons.

#### CHOREA

Chorea gravidarum is rare and, as emphasized by Campbell, it is most likely an acute infection like chorea minor, although some believe it is toxemic in origin. Willson and Preece collected 951 choreic pregnancies which occurred in 797 women reported in the literature. In more than 50 per cent of the cases, pregnant women with chorea give a history of having had a previous attack, more than one-third have had rheumatism and more than one-fourth have had both diseases previously. However, in spite of what some textbooks say, there is no great danger of recurrence during pregnancy in women who had the disease in childhood. Chorea is the most frequent acute nervous disease of childhood and if the danger of recurrence during pregnancy were great the number of cases of chorea gravidarum would be very large. But it is very small. Burr treated more than 3,000 cases of chorea in children but only a few of these returned with the disease when pregnant.

The disease occurs most frequently in primiparas, especially young ones, and it may or may not recur in subsequent pregnancies.

Chorea in pregnancy is serious because the mortality varies from 6 to 36 per cent. However, Vignes maintains that it is not a grave disease because in the 53 cases observed among the 38,000 deliveries at the Baudeloque Clinic, there was only one death. He mentions that in all the hospitals of Copenhagen during a ten-year period, there were 41 cases with only one death, one therapeutic abortion and one spontaneous abortion.

The mortality for the patients who have had chorea in childhood is less than one-half of what it is for those who did not have the illness, but the prognosis is especially bad for those who have recurrences of the disease in repeated pregnancies. Deaths are usually due to muscle spasms of the throat, tongue, and larynx followed by exhaustion, aspiration pneumonia, cardiac decompensation, psychosis, etc. Bacchauss says the disease is least serious for a child, more for a man, still more for a woman and most serious for a pregnant woman.

The fetal mortality varies from 50 to 70 per cent and many of the children born alive are abnormal. The chief danger to the child as far as heredity is concerned is an increased susceptibility to rheumatism which may cause chorea.

Most authorities agree that interruption of pregnancy or spontaneous labor cures the disease, hence they advocate evacuating the uterus if the patient's condition becomes worse in spite of conservative treatment. In some instances, however, the condition becomes aggravated after labor. According to Spiegelberg only half of the pregnancies go to term.

The prophylaxis of chorea consists of proper prenatal care. The essentials are sufficient rest, isolation, proper elimination, exercise without fatigue and freedom from worry, removal of all foci of infection and special attention to neurotic patients.

The treatment of chorea during pregnancy does not differ much from the usual treatment of this disease. Bed rest and sedatives are essential. If the patient's condition progressively becomes worse, it is best to empty the uterus. At or near term it may be advisable to perform a cesarean section in primiparas but in most instances simple induction of labor is preferable. Royston is of the opinion that the interests of the patient are best conserved by early emptying of the uterus as soon as a definite diagnosis of chorea is made. Since anesthetics are badly tolerated, local anesthesia should be used whenever possible. The obstetrician should always call a neurologist in consultation in these cases.

#### DIPHTHERIA

Diphtheria of the throat is rare among pregnant women just as it is very uncommon among adults in general. (Steen, Casavecchia, Ranson, Hirsch, etc.) However, when diphtheria does occur among women who are pregnant, abortion occurs in about one-third of the cases. This is due either to the toxemia produced by the disease or to respiratory disturbances which result from the laryngotracheitis.

Diphtheria of the genitalia among pregnant women is likewise rare and it is also very uncommon during the puerperium. According to Sigwart during a period of thirty years there were only 9 authentic cases of diphtheritic infection of puerperal

wounds reported in the German literature. In France, Bourut could collect only 43 cases but 33 of these occurred during one epidemic.

The first symptoms usually appear three to four days after infection. Most cases arise in homes and not in hospitals. The infection usually is contracted from some individual who has been in contact with the disease and not because the patient has diphtheria bacilli in her vagina, as some maintain. The diphtheritic inflammation has a tendency to spread on the surface and not in the depth. When during the course of diphtheria, there is involvement of the parametrium and peritoneum this is usually due to an associated streptococcus infection. Even when the diphtheritic infection exists alone and the local signs and symptoms are mild, the general condition is usually serious because of the concomitant toxemia. When there is an associated streptococcus infection, the outlook is grave.

Puerperal diphtheria runs exactly the same course as diphtheria in general. Under the influence of specific therapy the membrane is expelled in a few days and a cleansing process takes place. The end-results are bad when the disease has existed for a long time and serum has been given very late in the course of the disease. Naturally in cases of primary diphtheria of the genitalia, other organs may later become involved. Thus Bumm described a case of secondary laryngeal diphtheria, and Gourfein one of secondary diphtheria of the eye.

During the last few years much has been written concerning the occurrence of diphtheria bacilli in the nose of a large proportion of newborn children. Many outbreaks of nasal diphtheria among newborn have been reported, but the disease in these children was usually very mild. The general condition of the babies was usually good but frequently otitis media occurred as a complication. The outbreaks of this type were generally observed in Europe during epidemics of the grippe, especially during and for a few years after the war. Karlbaum, in 1919, reported such an epidemic in the Kiel clinic. Of 35 children who had nasal diphtheria 14 died. However, 24 of all the children had both nasal diphtheria and grippe. Twelve of the latter group of 24 died whereas there were only 2 deaths among the 11 children who did not have grippe.

Subsequent systematic examinations revealed the fact that the number of newborn babies in hospitals who had nasal diphtheria formed only a small proportion of the number of infants who harbored diphtheria bacilli in their noses. The latter children showed no bad effects but were bacillus carriers. This striking finding and also the harmlessness of diphtheria in the newborn is explained by the fact that 84 per cent of newborn show immunity against diphtheria toxin as determined by the Schick intracutaneous test. According to Schick this immunity is rapidly lost so that at the end of the first year only 30 per cent show this immunity. More breast-fed babies retain this immunity than bottle-fed children. This speaks for the transmission of immune bodies through mother's milk by means of which the infant can protect itself against a diphtheritic infection.

More uncommon than nasal diphtheria is diphtheria of the umbilicus in the newborn. Most of the infections appear at the end of the first week or during the second week. Some run a mild course whereas others are serious.

The source of diphtheria infections is usually difficult to find but in most cases carriers are responsible. Some authors maintain that diphtheria bacilli may be found in the vagina of healthy, pregnant and puerperal women. Others believe these bacteria are not true diphtheria but pseudodiphtheria bacilli.

In spite of the relative harmlessness of diphtheria in the newborn, it must be treated intensively. First of all serum in doses of 1,000-2,000 antitoxin units should be given and all infected children and carriers must be isolated. The attendants should all be examined to determine whether they are carriers, and all visitors should be excluded. There is no necessity to give serum prophylactically to healthy children in the same hospital or home. Attempts have been made to increase the immunity of newborn children by the administration of toxin-antitoxin but these attempts have been unsuccessful in spite of the fact that the amount of antitoxin in the cord blood can be increased fourfold by this means. Local antiseptic treatment is usually unnecessary.

There is no authentic case on record of the intrauterine transmission of diphtheria from the mother to the child. Some authorities advise the immediate separation of the newborn baby from its mother whereas others permit nursing at the breast. In the latter instance the mother should wear a large mask which covers both her nose and mouth. Sterile sheets or towels should be placed around the baby while it is with the mother.

#### ERYSIPELAS

Erysipelas during pregnancy is rare but if it occurs, pregnancy is interrupted in a certain proportion of cases. When the disease remains localized, the gestation proceeds

unmolested, but when there is a generalized infection, the uterus empties itself as a rule. It is exceptional to find an infection of the fetus by way of the placenta for Stolz could find only six such cases in the literature. During delivery the child may develop an erysipelas infection of the umbilicus. There was one such case at the Chicago Lying-in Hospital but not a single instance of erysipelas in any of the 35,000 mothers.

Even before our knowledge of the existence of bacteria, it was recognized that puerperal sepsis and erysipelas were similar if not identical processes. It was observed that both were endemic in maternities at the same time, many cases of severe puerperal sepsis began with erysipelas of the vulva, babies of septic puerperal patients became ill with erysipelas, doctors and assistants who cared for patients with erysipelas transmitted puerperal fever to recently delivered women, or during the care of patients with puerperal sepsis doctors or attendants themselves developed erysipelas. Virchow pointed out the similarity in the anatomic changes of both conditions. We know today that erysipelas and most cases of puerperal sepsis are caused by streptococci. Hence, it is easy to see why erysipelas of the vulva in a puerperal woman occasionally shows not only the usual skin manifestations but also spreads to the vagina, uterus and tubes and ends in a fatal peritonitis. Erysipelas in other parts of the body such as the face, runs its course during the puerperium just as it does in nonpregnant individuals and it does not necessarily endanger the genitalia.

The treatment of erysipelas during pregnancy or the puerperium is the same as in the nonpregnant state.

A child should not be permitted to nurse at the breast chiefly because of the danger of infection of the umbilicus and also because the mother is frequently very ill.

#### TYPHOID FEVER

In spite of the frequency of typhoid fever, especially a few years ago, the incidence of this disease during pregnancy is very low. Kiwisch in a series of 30,000 pregnancies saw only one patient with typhoid fever and at the Chicago Lying-In Hospital in almost 35,000 confinement cases there was likewise only one case. Liebermeister among 1,420 typhoid patients found 18 pregnant women (1.3 per cent) and Zülzer among 1,352 typhoid cases saw only 24 pregnant women (1.3 per cent). On the other hand, Villarama and Galang observed 64 cases of typhoid in pregnancy and the puerperium from 1917 to 1929 in Manila. Rhenter and Savoye reported nine cases in pregnancy and labor during an epidemic of typhoid fever in Lyon. M. Traneu-Rainer described in great detail the findings in the uterus of a woman who developed typhoid fever during the fifth week of pregnancy and who had a spontaneous abortion.

According to De Lee the mortality is higher among pregnant women than among others. This is borne out by French who claims that the death rate for gravid women with typhoid is 12 per cent. In Villarama and Galang's series the mortality was 31.3 per cent. Of the 20 women who died 11 were pregnant (26.1 per cent) and 9 were puerperal on admission to the hospital (45 per cent). Hence the death rate among the puerperal cases is much higher.

In 60 to 80 per cent of the cases where typhoid is associated with pregnancy, the latter is interrupted spontaneously. Corbin found 232 interruptions among 364 reported cases, an incidence of 63.7 per cent. In Villarama and Galang's series of 42 pregnant women, pregnancy was interrupted in 78 per cent. The earlier in pregnancy typhoid sets in, the more certainly will the gestation be ended. Termination of gestation does not cut short the disease, but of the 25 cases where pregnancy was interrupted by the disease, 21 patients (84 per cent) recovered. The uterus may empty itself in any stage of the disease even during the convalescence, but usually it does so in the second and third week of the illness.

Typhoid has no appreciable effect on labor and the puerperium. If, however, typhoid sets in just before labor or during the puerperium it may easily be confused with puerperal sepsis. However, in favor of typhoid are the absence of symptoms referable to the pelvic organs, leucopenia, roseola, relative bradycardia, characteristic stools, sero-diagnosis and bacterial examinations. Typhoid fever and puerperal sepsis may occur in the same patient and then the difficulty in making a correct diagnosis is very great.

A study of the leucocyte count in Villarama and Galang's series revealed that 17 had a blood count of less than 7,000, 20 had between 7,000 and 10,000 and 20 (35 per cent) had more than 10,000 white blood cells. The relatively high incidence of leucocytosis was due to the physiologic leucocytosis of pregnancy and also to complications such as puerperal infection (8), lobar pneumonia (14), acute nephritis (4), etc. A positive Widal test was obtained in 49 patients of this series.

The fetus is infected in about half the cases and in contrast to the mother the infection is general and not intestinal. In Villarama and Galang's series the fetal death



rate was 50 per cent, distributed as follows: 2 abortions, 13 miscarriages, 1 stillbirth, and 5 deaths after delivery. In a certain proportion of cases, not only do the typhoid bacilli go over from the mother to the fetus but also immune bodies, especially agglutinins. In the cases where the fetus is infected, the disease has usually been present in the mother a long time while in the cases where the children are born alive and uninfected, the disease has usually been of short duration.

During epidemics of typhoid, many mothers were vaccinated. They stood the vaccination well but the children did not benefit by these vaccinations. Typhoid bacilli do not reach the mother's milk but occasionally agglutinins are found in the milk. Hence a mother with typhoid may nurse her baby. However, since there are so many ways in which the mother can transmit the infection to her baby and since a mother with typhoid is usually too ill to stand the strain of nursing, the baby should be separated from its mother immediately after birth.

The treatment of typhoid during pregnancy does not differ from the customary therapy of this disease. Artificial interruption of pregnancy is practically never indicated, although some authors suggest emptying the uterus when the child is viable, to prevent the passage of bacilli to the fetus.

#### SMALLPOX

Smallpox seldom is seen in pregnant women. However, when it does occur among pregnant women the danger is greater than it is among nonpregnant individuals as indicated by Table I given by J. Novak:

TABLE I

AUTHOR	MORTALITY IN NONPREGNANT	MORTALITY IN PREGNANT WOMEN
Vinay	25%	36%
Willigen	11%	15%
Knecht	9%	35%

Willigen found a mortality of 9 per cent for primiparas and 17.3 per cent for multiparas, and this is probably due to the greater immunity of primiparas.

Pregnancy is terminated in from 30 to 69 per cent of the cases and this may occur in any stage of the illness, but most frequently in the eruption stage. The further advanced the pregnancy, the greater the likelihood of interruption. The cause of abortion and premature labor is not known, but it is probably hemorrhage in the decidua and primary death of the fetus. The average fetal mortality is 45 per cent. In most instances where the child is born healthy it remains so, but occasionally the disease shows itself a few days after birth. Intrauterine infection is common and a child may be born poek-marked as was Mauriceau, the famous French obstetrician. Some babies acquire the disease during labor and show signs of it after a thirteen- or fourteen-day incubation period. In a few cases, babies are born with smallpox though the mothers never showed any signs of the disease.

In mild cases, labor is usually uneventful but in severe cases, hemorrhage frequently occurs. Likewise excessive bleeding during the puerperium is not uncommon. Because of the danger of sepsis, vaginal examinations and intrauterine manipulation should be avoided as far as possible.

During epidemics of smallpox, pregnant women and their newborn babies should be vaccinated because no harm results from this procedure. Urner vaccinated 129 pregnant women regardless of the month of pregnancy, and there was not a single case of threatened abortion, miscarriage, or premature labor. All the infants of these mothers were likewise vaccinated on the third day after birth with good results. Lieberman reported a series of 351 pregnant women and their newborn babies who were vaccinated without bad consequences. All authors agree that vaccination of the mother during pregnancy resulting in a positive reaction does not convey any specific immunity to the baby. In Lieberman's series 71 per cent of the infants reacted with positive scars and in a series of 684 vaccinations in the newborn reported by Mensching, exactly the same percentage showed positive results. Even premature babies stand vaccination well.



Contrary to these findings in the human being, are the animal experiments of Ohtawara. He vaccinated pregnant rabbits to see if the newborn would acquire an immunity against smallpox. The findings were positive and this author believes the immunity of the newborn is an active one. In spite of this, in cases of smallpox it is best to separate the newborn baby from its mother immediately after birth.

Smallpox in the puerperal woman is treated in the same way as it is in other individuals.

#### CHICKENPOX (VARICELLA)

Chickenpox in pregnancy or the puerperium is an extreme rarity. Myers reported a case which occurred during the puerperium. The lesions were chiefly on the labia majora and the breasts. Varicella may be transmitted to the child in utero as evidenced by the case of Hubbard and Wells where the newborn showed typical chickenpox twenty-four hours after birth. The mother remained well. The child may become infected at the time of labor as occurred in the case of Lereboullet and Moricaud in which the mother manifested chickenpox the day of labor and the child showed it fourteen days after birth. Rhenter and Marnas report a case where a woman manifested chickenpox eleven days after labor, and the child showed typical varicella fourteen days later.

Chickenpox is harmless to both mother and child. Treatment is the same as in non-pregnant individuals.

#### MEASLES

Measles during pregnancy is usually serious because this disease frequently has a grave prognosis for adults. It may occur at any time during gestation and Fellner, who collected 30 such cases, reports a maternal mortality of 15 per cent. In Nouvat's series of 84 cases the death rate was 14 per cent.

Labor is usually normal but the puerperium is frequently complicated by diseases of the respiratory system and puerperal infection. Among the causes of death, pneumonia ranks first and following this are inflammatory changes in the endometrium and peritoneum which occur during the puerperium.

Pregnancy is interrupted in a large proportion of cases, the incidence reported by different authors varying from 45 to 76 per cent. The uterus usually empties itself in the exanthematous stage. The prognosis for the children is grave when pregnancy is interrupted. Esch reported a fetal mortality of 52.4 per cent. If a mother with measles gives birth to a healthy child without signs of the disease, the child will remain well even if it nurses its mother. Most newborn babies are immune to measles and this immunity lasts about three to five months. The immunity is usually due to transmission of antibodies through the placenta because most mothers have had measles.

Intrauterine diaplaental transmission of measles to the fetus does occur. In Nouvat's series of 84 cases the disease was transmitted to the child 21 times, or in 25 per cent of all the cases. Of the 21 babies, 13 showed the disease at birth and 8 after delivery. Of the former, 4 died (30.8 per cent) and of the latter 2 died (25 per cent).

The treatment of measles during pregnancy does not differ from the usual therapy. During epidemics of measles, pregnant women should be protected against the disease but there need not be strict isolation. De Lee, in his service at the Chicago Lying-In Hospital has seen many pregnant women who were exposed to this contagion from their sick children at home but in only one case did measles develop. This shows that even the imperfect isolation which is possible in the homes of the poor suffices to protect the mothers.

#### ENCEPHALITIS LETHARGICA

Within the two or three years following the 1918 epidemic of influenza, many cases of encephalitis lethargica were observed, and a fair number of these patients were pregnant or had recently been delivered. However, in almost 35,000 puerperal patients seen at the Chicago Lying-In Hospital, there was only one case of encephalitis lethargica. Roques collected from the literature 201 cases of encephalitis complicating pregnancy of which 171 were of the acute and the rest of the chronic type.

More cases of encephalitis are found among primiparas than among multiparas, but chiefly because young women are more likely to contract this disease than older women. The infection is more common in the later months and after delivery than in the first half of pregnancy. There is no agreement concerning the effect of pregnancy on the incidence of the disease but large statistics prove conclusively that pregnancy does not increase the susceptibility to it.

The mortality among pregnant women has been variously estimated to be from 5 to 70 per cent. The large variations are due to the difference in the number of cases

observed, the year and time of the year, the country and the virulence of the disease. Of 170 cases in pregnancy collected from the literature by Roques, the mortality was 42 per cent and this was about the same as for all persons attacked under similar conditions of age, sex, and locality. The death rate for encephalitis in Germany was 25 per cent, in Italy 21 per cent, in France 25 per cent, in Switzerland 29.4 per cent and in England 40 per cent. In Roques' own series of 21 cases the death rate was only 5 per cent. The mortality is somewhat greater when encephalitis occurs early in pregnancy and it is slightly higher in multiparas.

The symptoms are the same in pregnancy as in nonpregnant individuals during the same epidemic. Labor in some cases produces marked aggravation of the symptoms whereas in others improvement is noted. In the largest number of patients, however, there is no change in the woman's condition after delivery.

In the majority of cases pregnancy goes to term without any mishap. In severe cases pregnancy is sometimes spontaneously interrupted and in the patients who are extremely ill death occurs before the uterus can empty itself.

Labor and the puerperium are not complicated in any way by encephalitis, but labor is usually painless.

Encephalitis must be differentiated from the toxemias of pregnancy, such as eclampsia and hyperemesis gravidarum and also from chorea and grippe. Pregnant women with encephalitis are not more likely to develop the toxemias of pregnancy.

Most continental authors claim that fetal death before term is common whereas most British authorities deny this. A difference in virulence may explain this divergence of opinion.

The fetal mortality varies directly with the stage of gestation and the maternal issue.

Roques publishes the following table (Table II).

TABLE II

	FETAL MORTALITY
1. Fatal maternal infection before sixth month	100%
2. Nonfatal maternal infection before sixth month	37%
3. Fatal maternal infection after sixth month	68%
4. Nonfatal maternal infection after sixth month	22%
5. Fatal maternal infection during puerperium	14%
6. Nonfatal maternal infection during puerperium	7%

The total fetal mortality was 46 per cent. If an infant survives the first few weeks of life, there is little likelihood that it will subsequently acquire the disease. Encephalitis epidemica neonatorum though rare, exists as an entity but the mortality is not high. The virus can pass through the placenta, hence some babies can become infected before birth. However, there is little to substantiate the belief that infection of the child may take place through the mother's milk.

The disease should be treated in the same way as in the nonpregnant state. It is not advisable to interrupt pregnancy because neither abortion nor labor produces any change in most cases. Conservative therapy can nearly always be carried out with good results. Obstetric operations on these patients are dangerous and have a high mortality, but occasionally cesarean section is advisable. Patients should be carefully watched for the onset of labor, because labor may be completed without the knowledge of anyone due to the absence of pain. This increases the risk to the child. Breast nursing should not be permitted, because it is too much of a drain on the mother.

In a certain proportion of cases, acute encephalitis passes into the chronic state of Parkinson disease. According to Bland and Goldstein the literature leads one to the conclusion that at least 75 per cent of patients with acute encephalitis in pregnancy develop symptoms of paralysis agitans whereas the incidence of the chronic state after ordinary acute encephalitis is not more than 25 per cent. In general, pregnancy has a distinctly unfavorable effect on the chronic disease, but some patients have a normal pregnancy and labor and suffer no change in their condition. Pregnancy is not usually affected by Parkinson disease but in the severe cases, premature labor usually occurs. Labor is nearly always associated with less pain than in normal individuals. Puerperal complications are unusual and the child does not suffer as the result of chronic encephalitis in the mother.

Prophylactically patients who recover from an attack of acute encephalitis or from Parkinson disease should be cautioned against becoming pregnant for at least four years after recovery.

#### MENINGITIS

Epidemic meningitis during the puerperal state is uncommon and is practically always fatal. At the Chicago Lying-in Hospital in almost 35,000 labor cases, there was only one case of pneumococcus meningitis. In the literature up to 1910 Commandeur could find only 9 cases of purulent meningitis among pregnant women. The organism most commonly found is the pneumococcus. In the puerperium the usual source of origin is infected genitalia from which the infection reaches the meninges through the blood stream. A number of cases have been reported where newborn children of mothers with meningococcus meningitis also had meningitis; but thus far it has not been demonstrated that the meningococcus can pass over to the fetus in the uterus. Laffont and Mele report a case of fatal septicemia with meningitis where the responsible organism was the staphylococcus and this organism did pass through the placenta.

Tuberculous meningitis may also occur during gestation. Couvelaire and Lacomme report four cases which were observed among 600 women who were admitted to the special maternity for tuberculous patients attached to the Baudeloque clinic. Gaujoux and Boissier describe an additional case and analyze the 26 cases reported in the literature. One case of tuberculous meningitis was seen at the Chicago Lying-in Hospital.

Meningitis may rarely occur during puerperal sepsis and at autopsy in these cases very few anatomic changes are usually found.

In the early months of pregnancy, meningitis, especially the tuberculous type, may be mistaken for hyperemesis, whereas in the later months it may be difficult to differentiate from eclampsia, grippe, typhoid, encephalitis, and cerebral hemorrhage. Urinalysis and blood pressure readings will help to determine the diagnosis but a lumbar puncture is most essential. Lush reports a case of meningitis during pregnancy where hemorrhage in the meninges was a manifestation of pregnancy toxemia comparable to the hemorrhages which occur in the liver and kidneys during toxemia. The patient recovered after spontaneous emptying of the uterus.

The treatment of meningitis during pregnancy is not influenced by the presence of the gestation. The disease does not have a tendency to interrupt the gestation nor favor the onset of premature labor. Children born of mothers with tuberculous meningitis are not necessarily infected in utero, but the proportion of infected babies is greater among these mothers than among mothers who have pulmonary tuberculosis.

Meningitis at or near term is an indication for immediate postmortem cesarean section.

#### TETANUS

Tetanus is one of the most serious wound complications, and puerperal tetanus is perhaps the most dangerous of all. Spiegel, in 1915, collected 65 cases and found that 54 patients had died, a mortality of 83.1 per cent. Schneider was able to collect 111 cases reported up to 1925, including two of his own, and the total mortality was 91 per cent. Sommer found ten more cases up to 1929. Since the extensive use of tetanus antitoxin, the mortality has been reduced, but it is still frightfully high. During pregnancy the period of incubation varies from four to twenty-one days with an average of nine days. This is shorter than the incubation period in nonpregnant individuals, and this is due to the favorable absorptive processes in the puerperal uterus. The shorter the period of incubation, the more dangerous the disease. Puerperal tetanus is especially serious because the cramps frequently affect the pharyngeal muscles early, then they involve the respiratory muscles and cause death from choking.

Prophylactic measures against puerperal tetanus are very reliable, but the treatment of the condition after it has broken out is most ineffective. In cases where there is danger that tetanus may occur, prophylactic doses of tetanus antitoxin should be given regardless of the presence of pregnancy. Since the effect of the antitoxin does not last more than a week, the injections should be repeated. The later the antitoxin is given the larger the dose must be. In general the treatment is the same as for nonpuerperal individuals. Removal of the uterus has been tried but the results have not been encouraging.

Ten Broeck and Bauer found that when tetanus antitoxin is present in the mother's blood serum, it is also to be found in the cord blood of the baby. In most cases, the amount of antitoxin in both bloods is the same. Colostrum also contains the tetanus antitoxin hence infants may receive a supply of antitoxin through the mother's milk. However, the serious condition of the mother is usually a contraindication to breast feeding.

In Peiping approximately one-third of the people are carriers of tetanus bacilli but there is a comparatively low incidence of tetanus. In Hawaii according to Milnor tetanus is very prevalent and the death rate is about 92 per cent. Puerperal tetanus, however, is less common than that due to punctures in the foot and hand.

The only case observed at the Chicago Lying-in Hospital was in a patient delivered at home by a midwife. Just before death the dispensary service was sent for.

#### WHOOPIING COUGH

Whooping cough is rare in adults hence it is very infrequent during pregnancy. Only one case was observed in almost 35,000 labors at the Chicago Lying-in Hospital. The severe coughing associated with this disease may cause rupture of the membranes and premature interruption of pregnancy.

The treatment of pertussis during pregnancy is the same as usual. Hrabouky cured whooping cough in a pregnant woman near term by means of x-ray treatments. A normal child was born at term.

Intrauterine infection of the fetus has not yet been proved. The baby should be separated from its mother immediately after birth because it has no immunity against the disease and because of the great danger of bronchopneumonia which is nearly always fatal.

Phillips reported two cases of pertussis contracted at birth and in both cases the infection was contracted from an obstetric nurse who was in the first week of the attack of whooping cough. This author saw six cases of pertussis in three different families within one year and all were contracted from nurses who had coughs which they considered to be ordinary "colds." A nurse with a cough should not take care of obstetric patients.

#### MUMPS

Although orchitis occurs as a complication in about 30 per cent of males who have epidemic parotitis, involvement of the ovaries in women is rare. It may occur more frequently than is supposed but we have no way of recognizing it definitely because it is usually symptomless. When mumps affects the ovaries it produces painless changes without any alteration in size. Daleas reports a pregnancy after oophoritis associated with mumps. He mentions that Naudin who reported the persistence of menstruation in 28 women after an attack of mumps did not observe a single pregnancy among them.

There are only a few case reports in the literature of the occurrence of mumps during pregnancy. In one case at least the disease was transmitted to the newborn baby. There was only one case of mumps at the Chicago Lying-in Hospital in almost 35,000 deliveries. Moore recently reported a case which complicated late pregnancy.

#### PLAGUE

Very little is known about the occurrence of plague during gestation. Pregnancy is usually interrupted by the disease, as proven in many epidemics. However, Laurentie and Tyan believe that gestation is interrupted only when there is a generalized infection. If the disease remains localized, pregnancy continues unmolested. The disease has a bad prognosis for both mother and child because the estimated mortality for the mother is about 80 per cent and for the child about 88 per cent. The mother sometimes dies before the fetus is expelled. Some babies which are born alive and healthy remain so. Three fetuses which were obtained in intact membranes were examined by the German Plague Commission and found to have parenchymatous degeneration and hemorrhages of the viscera but no organisms could be detected. Hence fetal death is most likely due to toxins.

The puerperal state does not aggravate the disease and vice versa, plague has no special effect on labor. There may or may not be complications during the puerperium.

Laurentie and Tyan administered antiplague serum to a pregnant woman with plague and she recovered. The child was permitted to nurse at its mother's breasts and it remained healthy. This was one of six cases seen by the authors in an epidemic at Beyruth. All six patients recovered and there was only one abortion. The other five babies were born alive and healthy. The authors advise that patients should be given serum treatment regardless of the presence of a pregnancy.

#### ANTHRAX

Many cases of anthrax complicating pregnancy have been reported and most of them ended fatally (Schmorl, Marchand, Hünicken, etc.). In some cases, there is premature interruption of the gestation and in others death occurs before the uterus is emptied.

In most cases the disease has its origin in a skin injury and begins with the well known malignant pustule. It may also begin in the lungs or in the intestines. In pregnant women as with others, it is nearly always possible to obtain a history of contact with infected animal matter such as skin, leather, splicen, hair, etc., from which the infection was derived. In all but three cases reported in the literature, the children were born dead or died shortly after birth. In some cases anthrax bacilli were found in the fetal organs.

In animal experiments it has been found that anthrax bacilli frequently but not always pass from an infected mother to the fetus. The bacilli have also been found in the milk of infected animals.

There are reports in the literature of seven cases where the disease was transmitted from the mother to the fetus within the uterus. In at least four of these cases, there was a pustule on the face of women who were apparently healthy, yet the blood cultures showed large numbers of anthrax bacilli.

If a baby is born alive, it should not be permitted to nurse its mother for the mother's sake as well as its own.

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#### Erratum

In the article by Samuels and Edlavitch in the March issue, on page 399, last sentence in the third paragraph, the percentage of mortality reported by Burch and Burch should read 4.5 instead of 7.5.

# Selected Abstracts

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## Eclampsia

Olsen, A.: *Examinations of Renal Function in Eclampsia and Allied Toxemias*, Acta Obst. et Gynec. Scandinav. 12: 164, 1932.

A summary is given of the views of different periods and changing theories concerning the nature of the kidney of pregnancy and its importance in the pathogenesis of eclampsia, and an account is given of the diversity of opinions as to the nature of this disease.

As both hypertension and the tendency to edema formation in pregnancy can occur without any kidney disease, it is necessary in the classification of the kidney of pregnancy to lay the main stress on function, but kidney function in cases of eclampsia and kindred conditions must be compared with the function in normal pregnant women, not with the function in normal nonpregnant persons.

In normal pregnant and parturient women 353 determinations of urea and 74 determinations of N.P.N. were made, and it was shown: that (1) in normal pregnant women urea is lower than in normal nonpregnant persons, and that the difference is so considerable, that it must be biologically conditioned; (2) the N.P.N. is reduced in normal pregnancy, but only by the quantity of N which corresponds to the reduction of urea; (3) in urea there is no certain difference between the successive fortnightly periods during the last 10 weeks of pregnancy or in parturition.

In 44 pregnant and parturient women suffering from hypertension, 54 from albuminuria, 34 from hypertension plus albuminuria, 42 from hypertension plus albuminuria plus edema, 24 from preeclampsia and 27 from eclampsia (besides 13 with various other complications of pregnancy) 1100 determinations of urea and 300 determinations of N.P.N. were made. These investigations show that (1) in all the groups there is an increase of urea as compared with the normal figure, and that the difference—with the exception of the first group—is so great that it must be biologically conditioned; (2) this difference increases from group to group but even in cases of eclampsia pathologic values are rarely seen and sometimes even low ones; (3) in cases of eclampsia and preeclampsia a considerable increase of urea (up to 151 mg. per cent) is generally seen during the first days after delivery, whereas an increase is rare in the other groups; (4) fever, narcosis, hemorrhage and pyuria can be left out of account as causes of the increase observed.

To make a distinction between uremia caused by overproduction and uremia caused by retention, direct examinations of the kidney function are necessary.

The results of functional tests made are as follows: (1) Among normal pregnant women two types may be distinguished: One with slightly increased, the other with slightly reduced function in comparison with normal nonpregnant persons. During pregnancy, therefore, the limits of what is normal must be drawn somewhat wider than outside of it. (2) During pregnancy—even in cases of considerable hypertension, serious albuminuria and generalized edema—no case of certain reduction of renal function was observed without simultaneous cerebral symptoms. (3) In cases of eclampsia and preeclampsia there is during the first days following delivery in 85 per cent of all cases a reduction of kidney function, which during the first period after delivery or during the Stroganoff treatment is often of such a degree as to suggest a discontinuation of the function.

J. P. GREENHILL.

Konrad, E.: The Effect of Atmospheric Changes on the Incidence of Eclampsia, *Arch. f. Gynäk.* 143: 9, 1930.

Konrad observed nine patients who developed eclampsia on days when the relative humidity of the air was more than 20 per cent. Two other cases, which terminated fatally, occurred on days when the relative humidity was 20 to 30 per cent. The author is of the opinion that a definite cause and effect relationship exists between the moisture content of the air and the relative frequency of eclampsia. A severe winter accompanied by a heavy snowfall, followed by rapid melting in the spring results in increased humidity and one must therefore expect an increase in the eclampsia incidence.

RALPH A. REIS.

Theobald, G. W.: The Causation of Eclampsia, *Lancet* 218: 1115, 1930.

Eclampsia is considered a syndrome, and its individual features are attributed to the absorption of toxins from the intestines which are in a partial state of stasis. The action of the disease is due to: hypoglycemia, edema of or hemorrhage into the brain, or toxins acting directly or indirectly upon the nervous system. Calcium acts as a protector, provided enough is ingested and sufficient vitamin D is present to allow the utilization of the mineral.

The author's experiments on dogs produced convulsions and in certain instances comparable liver and kidney lesions. Intravenous injections of feces, eclamptic blood, oxylates, or guanidine carbonate, and also the separation of the placenta were fruitless. A lean meat diet, even though sufficient vitamins were present, lacking in calcium did not prevent parenchymatous lesions. Since the animal experiments supported his hypothesis the writer believes that eclampsia is prevented by the adequate use of calcium and vitamin D, especially in the absence of intestinal stasis.

This theory is supposed to explain all the known facts concerning this disease.

H. C. HESSELTINE.

Brown, R. Christie: The Intestinal Origin of Eclampsia, *Brit. Med. J.* 2: 859, 1930.

It is found clinically that the kidney is excreting albumin and is no longer acting as an efficient barrier to the blood colloids. Similarly the liver may cease to act as a barrier between the portal and systemic circulation. Thus the toxin is allowed to pass unchanged into the systemic circulation producing a secondary toxemia which may be the origin of the fits.

On the basis of the above theory, Pavlov in his experiments on dogs with their portal circulation cut off from the liver and sending it directly into the systemic circulation was able to produce convulsions and coma by feeding a high protein diet.

The above is explained on the basis that the liver acts as a detoxicator of poisonous substances carried by the portal vein. It has been pointed out by Gibbon Fitzgibbon and confirmed by the author that the eclamptic patient usually suffers from constipation and dietetic excess and her detoxicator, the liver, is damaged, which on analogy with the kidney may allow noxious substances from the portal vein to pass into the general circulation.

F. L. ADAIR.

Seitz, L.: The Prophylaxis and Treatment of Eclampsia and Preeclampsia, *Arch. f. Gynäk.* 142: 52, 1930.

The most effective means of intelligently combating eclampsia is by active and intelligent prophylaxis. It is possible to greatly decrease and almost entirely eradicate pre-eclamptic symptoms by a careful regulation of diet, especially the vitamins, control of the protein intake and output, salt regulation and the avoidance of heavy physical labor. Nephropathies and preeclampsias should be treated by starvation for two to three days followed by saltfree diet and bedrest. If the symptoms improve this line of treatment may be safely continued. The pregnancy must be interrupted immediately, however, if

the symptoms remain stationary or become worse. The most important criteria of failure of improvement are a decrease in galvanic sensitivity, an increase in blood pressure and a continuation of the subjective symptoms. In true eclampsia the pregnancy must be terminated at once, by forceps if dilatation is complete, otherwise by cesarean section.

RALPH A. REIS.

**Rissmann, P.: The Prevention and Treatment of Eclampsia on the Basis of 111 Observations, Med. Klin. 26: 383, 1930.**

The author believes that eclampsia is caused by disturbances in the metabolism which are produced by pregnancy plus an alimentary factor. This he believes is borne out by the fact that none of the patients who follow out his diet develop eclampsia. He recommends a vegetable diet, and forbids strong spices, alcohol in large amounts, meat and raw eggs. Every woman who develops eclampsia has a venesection of at least 500 c.c. of blood and she receives luminal. Magnesium sulphate is no longer given but labor is hastened, especially by cesarean section. The latter operation was performed in 20 per cent of the author's cases. His gross maternal mortality among 111 cases was 6 per cent and the fetal death rate was 18 per cent.

J. P. GREENHILL.

**Schmechel, Arthur: Recurrent Eclampsia, Zentralbl. f. Gynäk. 53: 2405, 1929.**

An attempt was made by means of a questionnaire to follow up 238 cases of eclampsia occurring in the course of 27,340 births at the Dresden Frauenklinik between the years 1915 to 1927, with the following statistics: 37 cases died primarily, with eclampsia; 2 cases died in the next few years, causes unknown; 41 cases were not located; 158 cases replied to the questionnaire.

Of these 158 cases, only 83 had more pregnancies, as follows: 35 had no eclampsia, 42 per cent; 33 had preeclamptic symptoms, 40 per cent; 15 had recurrent eclampsia, 18 per cent.

These statistics are in accord with those published by Zangemeister, who found an incidence of 15 per cent of recurrent eclampsia in 76 cases, and do not coincide at all with incidences of 1.5 per cent and 3 per cent reported by other writers, (Lichtenstein, Bittner, Olshausen, Goedecke, Benthe, and others).

The question arises as to whether the cases of recurrent eclampsia were not in reality due to chronic nephritis. The author claims that they were not, and cites the fact that eclampsia is known to recur after a patient has had a normal birth without eclampsia (this happened in his series). He states that in only one out of 160 of his cases was a true chronic nephritis found.

The writer believes that recurrent eclampsia runs a milder course, for there was only one death in his 15 cases, and that was due to premature separation of a normally implanted placenta.

WILLIAM F. MENGERT.

**Kobes, Rudolf: The Late Results in Cases of Eclamptic and Preeclamptic Women, Zentralbl. f. Gynäk. 54: 666, 1930.**

Thirty-two cases of eclampsia, ante, intra, and postpartum, and 19 of preeclampsia were studied from the standpoint of late results. Of the eclamptics 29 were delivered operatively, 19 by section, 8 by forceps, and 2 by version. On discharge, about the 19th day, there was no pressure more than 135 mm., there was albumin in 11 cases and casts in 7, but none of the patients had edema. Check-up examinations, which included blood pressure, Volhard's concentration test, and nitrogen determinations, three to eighty-five months after the appearance of the disease did not show evidence of a single case of residual nephritis.

Of the 19 preeclamptics 15 were delivered operatively (including 2 manual dilations and 2 craniotomies). Of these 19 cases 13 had previous histories of kidney disease. In general, the author found that in this series of so-called preeclamptics, complete recovery was not so satisfactory as in the outspoken eclamptics. Two of the pre-



eclampsies showed definite chronic nephritis, and 2 others showed irreparable retinal damage. The author states that in this latter series of cases it was impossible to rule out previous kidney disease unrelated to pregnancy because of unreliable histories.

WILLIAM F. MENGERT.

**Klaften, E.: Detachment of the Retina in Eclampsia, Med. Klin. 27: 588, 1931.**

According to Klaften, since 1855 when von Graefe described the first case of detachment of the retina there have been only 60 such cases reported associated with retinitis of pregnancy. In recent years with more frequent ophthalmoscopic examinations of pregnant women with renal disturbances and eclampsia, we know that the eye grounds show many changes and of varied severity. The most important and the most serious are retinitis, neuroretinitis and ablation of the retina. During the last ten years among 25,000 labor cases and among 206 cases of eclampsia, the author observed many instances of albuminuric retinitis, neuroretinitis, papillitis, edema of the retina and hemorrhagic retinitis. However, he encountered only one case of detachment of the retina. It is characteristic for these pathologic conditions to retrogress rapidly.

He agrees with those who maintain that detachment of the retina is an absolute indication for the termination of pregnancy. The earlier the interruption the more rapid and complete is the return of vision. Since in all of these patients the blood pressure is very high, there is danger of apoplexy. Furthermore in all of these cases, sooner or later, eclampsia or eclamptic uremia develops.

J. P. GREENHILL.

**Kuestner, H.: Eclampsia in Saxony in the Last Ten Years, Arch. f. Gynäk. 145: 577, 1931.**

For the last ten years the law in Saxony requires that eclampsia be reported and Kuestner is therefore able to report the statistics for all eclampsias occurring from 1920-30. The number of births per year has dropped from 122,940 to 83,750 but eclampsia has increased from 194 per year to 238. The frequency in 1920 was 1 in 640 and in 1930 was 1 in 350. The average for the ten year period was 1 in 430. The author believes this marked increase to be due to the marked increase in meat consumption. In the metropolitan areas the incidence is 1 in 380 and in the rural districts 1 in 580. These differences the author attributes first to dietary differences, secondly to the differences in exposure to ultra-violet rays and sunshine and thirdly to differences in muscular activity which produce differences in metabolism.

The smallest incidence was found in the first half of July, August and October and the greatest frequencies in the second half of April, July and December. The incidence was also found higher when the fetus was a male and higher in multiple than in single pregnancies; 78 per cent occurred in primiparae with a 13 per cent mortality, 11 per cent in secundiparae with a 20 per cent mortality and 12 per cent in multiparae with a 23 per cent mortality.

Spontaneously delivered were 25 per cent and by forceps another 25 per cent. The gross mortality was 15.7 per cent, being 16.4 per cent for the spontaneous and 15.2 per cent for the forceps group.

RALPH A. REIS.

**Thulin, E.: The Treatment of Eclampsia at the Gothenburg Maternity From 1918 to 1928, Acta Obst. et Gynec. Scandinav. 9: 554, 1930.**

The author reviewed the results of treatment in 167 cases of eclampsia. During the years 1918-19 there were 42 cases and the treatment was active. The maternal mortality was 7.1 per cent and the fetal death rate was 25 per cent. During 1920-28, 125 patients were treated individually, according to the middle line therapy. The maternal death rate was 11.2 per cent and the fetal mortality was 29.5 per cent.

J. P. GREENHILL.

**Klaften, E.: Eclampsia, Arch. f. Gynäk. 146: 386, 1931.**

Klaften reports the occurrence of eclampsia at the Peham clinic in Vienna during the last ten years, there being 178 cases from 1921 to 1928 and 28 cases from 1928 to 1930

inclusive. This marked decrease in the incidence of eclampsia is one which has been noted by other observers and is due to increased prenatal care and to increased efficiency in prophylaxis. The mortality rates show the same marked decrease there being 13 deaths among the 178 patients but only 1 among the last 28. The total maternal mortality was therefore 6.7 per cent. The mortality rate for young primiparae was 4.6 per cent, for old primiparae 4 per cent, and for multiparae 15.5 per cent. The total fetal mortality was 45 or 21 per cent and for fetus over 2000 gm. was 12.3 per cent; 8 died during delivery.

Convulsions occurred in 67 per cent intrapartum, 27 per cent postpartum, and 6 per cent antepartum. Of the 55 postpartum eclamptics, 31 were primiparae and 24 multiparae. Of all primiparae 1.29 per cent developed eclampsia and 0.5 per cent of all multiparae. The largest number (34) developed during July, the smallest number (11) during December. Postecclamptic psychoses developed in 8 or 3.8 per cent.

Of the 151 patients with antepartum and intrapartum eclampsia 70 delivered spontaneously with two deaths, 81 had operative deliveries and 9 died. Of these, 46 were delivered by midforceps, 11 by version and extraction, 8 by craniotomy, 9 by bag induction, and 7 by cesarean section. There were 37.6 per cent fetal deaths among the operative deliveries and 19.6 per cent among the spontaneous deliveries. A study of the cesarean section deliveries in eclamptics for the last fifteen years shows no improvement in maternal or fetal mortality nor in the incidence of postpartum eclampsia over those delivered vaginally.

RALPH A. REIS.

**King, Gordon:** Eclampsia in Chinese Patients, *National Med. J. China* 16: 653, 1930.

The incidence of the disease during the last eight years in the Peiping Union Medical College Hospital has been once in 71.4 deliveries, making 33 cases in all. The majority of the cases were encountered in the autumn and winter months. Primiparae predominated over multiparae in the proportion of 3 to 1. In over 75 per cent of the cases no antenatal care had been received. Only in 12 per cent of the cases had regular antenatal care been given, and in this group there was no mortality.

The distribution of cases was, in round figures, as follows: Antepartum eclampsia: 60 per cent of cases with an average of 11 convulsions; intrapartum eclampsia: 30 per cent of cases with an average of six convulsions; postpartum eclampsia: 10 per cent of cases with an average of four convulsions.

Definite changes in the fundus oculi are found in most cases of eclampsia.

Tests for hepatic efficiency, notably the levulose tolerance test, give evidence of impaired liver function. Conservative treatment, based upon Stroganoff's method, is favored, cesarean section only used in exceptional cases. There were 4 maternal deaths giving a mortality of 12.1 per cent. The fatal cases all belonged to the antepartum group. There was a fetal mortality of 44 per cent.

Adequate follow-up examinations were possible in 10 cases of the series. Of these two went through a subsequent pregnancy normally. Two other patients, however, developed chronic nephritis. The real danger of this latter possibility should be borne in mind in giving an ultimate prognosis.

C. O. MALAND.

**Koteljnikov (Moscow):** 700 Cases of Eclampsia, *J. Akusherstva i. Zenskieh Boleznej*. 42: 196, 1931.

The material discussed covers the period from 1907 to 1930. In 79,301 deliveries there were 684 cases of eclampsia. In 1908 eclampsia occurred in 2.5 per cent of all deliveries; 1.2 per cent in the deliveries during 1916, 1.4 per cent during 1918, and 0.2 per cent in 1925. Of these 684 cases 87 died. The occurrence of eclampsia varied somewhat according to the season of the year, 3.4 per cent in winter, 3.1 per cent in spring, 2.7 per cent in autumn, and 2.5 per cent in summer. The maximum number of deaths, 17 per cent, occurred in October and the minimum, 1.9 per cent, in July.

In the pre-war period from 1907 to 1914 there were 306 eclampsia patients in 30,676 deliveries; from 1915 to 1922, 251 cases in 32,079 deliveries. Eclampsia was found to occur five times more frequently in primiparae than in multiparae and there was 2.5 per cent of repeated eclampsia. One patient reported had eclampsia during her first delivery and again in her ninth.

There were 12 cases of eclampsia in the fourth to sixth lunar months and 269 cases during the puerperium. Convulsions appeared from six hours to ten days after delivery. Seven patients had eclampsia without convulsions. All of them were operated upon. One patient died and the diagnosis was confirmed by the pathologist.

In this series of 684 cases, 527 (77 per cent) had albuminuria and 62 of them died. Blood corpuscles were found in the urine of 63 cases (9.2 per cent), and 22 of these patients died. Albumin was absent in 94 cases (13.8 per cent), of this number three died. Fatal termination depends not only upon the number of convulsions, but upon their strength and the intervals at which they occur. In the material covered by the author convulsions in frequent succession led to death.

Attention should be called to the fact that the author does not exhibit particular accuracy in his statistics, also the title number of 700 cases does not correspond with the text.

ALEXANDER GABRIELIANZ.

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## Item

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### AMERICAN BOARD OF OBSTETRICS AND GYNECOLOGY

Late applications for certification at the meeting of the Board to be held in Milwaukee, Tuesday, June 13, must be made immediately as no more applications can be received for this examination after June 2. This general, clinical examination by the Board is to be held at The Milwaukee County General Hospital beginning at 9 A.M., June 13, the day before the beginning of the scientific session of the American Medical Association.

All diplomates and candidates are urged to register early at A. M. A. headquarters for attendance on the scientific sessions of the Section on Obstetrics, Gynecology and Abdominal Surgery of the American Medical Association for which an especially interesting program has been arranged.

Tickets for the dinner and Round Table Conference of the Board to be held informally at the Hotel Schroeder, at 7 P.M. Wednesday, June 14, should be obtained at A. M. A. headquarters when registering. All diplomates, candidates, and any physicians interested in obstetrics and gynecology may attend by applying for tickets.

For further information and application blanks address Dr. Paul Titus, Secretary, 1015 Highland Building, Pittsburgh, Pennsylvania.

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## Original Communications

### (2) EPITHELIAL PROLIFERATION IN THE CERVIX UTERI DURING PREGNANCY, AND ITS CLINICAL IMPLICATIONS

J. HOFBAUER, M.D., BALTIMORE, MD.

*(From the Department of Obstetrics, the Johns Hopkins University and Hospital)*

THE purpose of this paper is to direct attention to peculiar and, as far as I have been able to determine, hitherto unknown manifestations of hyperplasia of both the surface mucosal epithelium and the glandular epithelium of the cervix in pregnant women. These epithelial variations encountered in the course of a systematic investigation into the architecture and the histology of the pregnant uterus aroused our interest from a morphologic and a diagnostic point of view. It was felt, in addition, that our findings may offer a new avenue of approach to the mooted problem concerning the occurrence of cervical cancer in women who had previously been pregnant.

By means of description and illustration the development of the various stages of the alterations in the morphology of the cervical epithelium during gestation will be presented, and an attempt will be made to correlate properly the data thus assembled. It is due to the fact that the pregnant uteri were immersed in fixing fluids immediately upon their operative removal, that the finer histology of the tissues under consideration could be studied to advantage.

Fig. 1 illustrates the first step of epithelial activity resulting in a reduplication of the cervical epithelium in a four months' pregnant uterus which had been removed for severe break of compensa-

\*Presented at the University of Chicago, October 7, 1933.

NOTE: The Editor accepts no responsibility for the views and statements of authors as published in their "Original Communications."

tion. Between the original columnar cells and the basement membrane is noticed a new layer of low cylindrical cells whose nuclei stain deeply with hematoxylin. This double layer of surface epithelium occurs in discrete places, while normal epithelial conditions prevail in the neighboring areas. Occasionally, there appears beneath the cervical columnar epithelium a new layer of polygonal elements resembling the basal cells of the epithelium of the vaginal portion. (Fig. 1.)

Another specimen obtained at the fourth month (Fig. 2), shows the pregnancy changes of the cervical epithelium more advanced. As a consequence of the rapid proliferation of the surface epithelium, there appears a compact aggregation of comparatively small epithelial elements, arranged in five to six layers. This new cellular formation stands out prominently by its dark color, due to the great affinity to stains of the

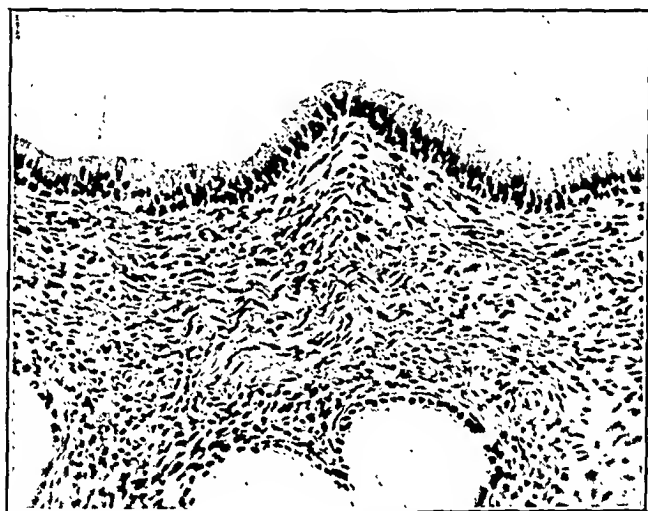


Fig. 1.—Photomicrograph showing reduplication of cervical epithelium in the fourth month of pregnancy. X200.

nuclei which occupy the greater part of the cells, while their cytoplasm is rather scanty. A distinct, if slight variation in size and shape of these cellular elements is readily discernible. Furthermore, the down-growth of such structures into the underlying connective tissue may at first glance create the impression of beginning tumor formation, passing the borderline of malignancy. In spite of the invasiveness of such structures, however, the integrity of the basement membrane can be definitely established by using the differential stain, e.g., the molybden-hematoxylin technic. Another characteristic feature of the pregnancy changes of the cervical epithelium consists in the occurrence of numerous vacuoles in the structures just described. Within the large vacuoles there are visible polymorphonuclear leucocytes, and occasionally also lymphocytes. Several adjacent vacuoles may coalesce forming large, clear spaces which are filled with mucin.

The details of such multilayered formations are clearly demonstrated by Fig. 3, taken with higher magnification from a section through the cervix of a five months' pregnant uterus. Attention is drawn to the fact that cells of the type of the original cervical epithelium are only



FIG. 2.—Photomicrograph of cervical epithelium in the fourth month, showing ingrowth of the multilayered epithelium. Note formation of large vacuoles. X90.

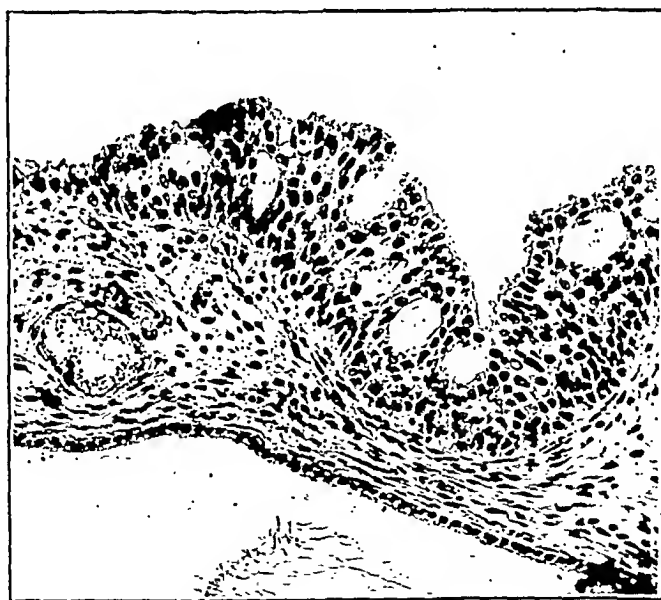


FIG. 3.—Higher magnification of part of FIG. 2, showing phenomena in the proliferating epithelium. X176.

visible in the uppermost row, while several layers of cells of the transitional type have developed beneath them. In places, the latter elements push up and eventually replace the columnar cells. Numerous

plasma cells arranged in strands are visible within the core of the folds of the cervical mucosa.

Another section obtained from the same uterus illustrates the course



Fig. 4.—Specimen of the fifth month of pregnancy, showing proliferation of cervical epithelium. Note abrupt transition of normal epithelium to actively proliferating subepithelial cells which push up the original columnar cells. Note the numerous vacuoles with lymphocytes and polymorphonuclear leucocytes. X140.



Fig. 5.—Mitosis in newly forming cell layers. X800.

of the developments at both sides of a fold of the cervical mucosa, while at the depth of the fold the cervical epithelium has retained its original character. It is worthy of note that at the right it is apparent that

there is no basement membrane beneath the cellular hyperplasia, while in other places the membrane containing flat elongated cells with occasional mitoses can be clearly discerned. The possibility of a confusion of such structures with a malignant growth is still enhanced by the occurrence in the newly formed layers of mitotic figures (Fig. 5).

Similar phenomena of epithelial proliferation occur in the stratified epithelium of the vaginal portion and within the cervical glands. Evidence of the invasive activities of the newly formed cells arising from the gland epithelium is obtained by reference to Fig. 6. The picture represents the condition of affairs in a cervical gland of a uterus removed during the seventh month of pregnancy. In various places slender polypoid excrescences protrude into the glandular lumen, while beneath the columnar epithelium a massive proliferation of small, darkly stained cuboidal cells with ill defined cell boundaries, has taken



Fig. 6.—Photomicrograph of cervical gland in the seventh month of pregnancy. Note invasion of connective tissue by sheets of small dark cells, and the presence of vacuoles within this new formation. X100.

place, in which here and there manifestations of mitosis occur. The gland appears ensheathed by a conspicuous multilayered aggregate of cells which are dipping down into the connective tissue spaces, the basement membrane remaining intact, however. The massive invasion of the cervical stroma by such tongues of young cells derived from the cervical epithelium is demonstrable in several of our specimens. No round cell infiltration of the connective tissue as a response to, or a defense mechanism against that epithelial cell invasion was observed. Again, the occurrence of large vacuoles in such cell aggregates was a constant feature. Of great interest is the presence of decidua-like cells in the connective tissue layer adjacent to the proliferating cervical epithelium, and also the occurrence of occasional mitotic figures in the stroma.



The epithelial activity of the cervical epithelium during pregnancy with a concomitant development of large vacuoles in such structures may be conducive to the occurrence of bizarre formations, as repre-



Fig. 7.—Bizarre formation in cervical epithelium during the eighth month of pregnancy. X150.



Fig. 8.—Photomicrograph of cervix at term showing the formation of solid cell nests, which are dipping down into the connective tissue spaces. X176.

sented by Fig. 7. In other places multinuclear giant cells are occasionally visible within the layer of the cervical epithelium.

At term, the infiltration of the proliferating cervical epithelium into the underlying connective tissue quite often results in the formation of compact alveoli. The crowding of cells of the transitional type con-

taining large hyperchromatic nuclei is evident in the periphery of such cell nests, while the center shows a tendency toward vacuolization. Their boundaries are marked by a well-defined basement membrane. Fig. 8 illustrates an example of such a phenomenon. No accumulation of lymphocytes or of round cells is visible in the immediate vicinity



Fig. 9.—Photomicrograph of cervix removed forty weeks after delivery, showing persistence of part of the proliferated epithelium. Note abrupt transition of the protruding mass to the normal regenerated cervical epithelium. X200.

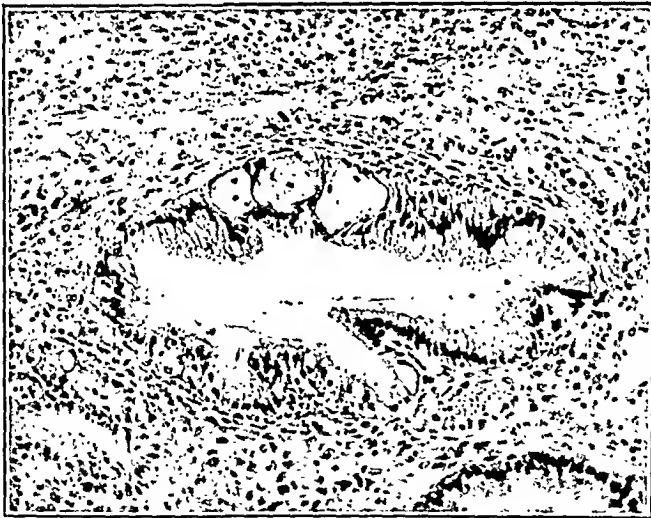


Fig. 10.—Formation of goblet cells in the epithelium of cervical glands at term. Note small vacuoles at the base of the epithelium, and the presence of lymphocytes within the large vacuoles. X175.

of the structures under consideration, the hyperplasia of the epithelium occurring without any signs of inflammatory reaction.

Having become familiar with the extensive cellular activity of the cervical epithelium during pregnancy, the question suggested itself to ascertain for how long a period of time following delivery, such struc-

tures were recognizable. At present, however, no adequate answer can be given. We have been able to trace the persistence of the structures described above to the fortieth week after the termination of pregnancy. Fig. 9 represents the findings in a cervix of a uterus removed ten months after delivery. It was of great interest to see that the cells of this structure, which was found to project far beyond the level of the neighboring columnar surface epithelium, had retained all their characteristics. No indication of any retrograde process is visible, the cells apparently having remained in a state of full vitality. No indication of undermining of this structure by the epithelium of the cervical canal is visible.

There remains another microscopic finding to which I should like, in concluding, to call attention. Among the principal epithelial variations encountered in the cervical mucosa of the pregnant uterus, we have noticed the formation of vacuoles in the basal portion of the cells. These vacuoles occur as the result of the secretion of droplets of cytoplasm which do not coalesce readily. When such vacuoles in neighboring cells enlarge and by reason of increasing pressure, their adjacent surface membranes break down, globules of excessive size form which render such specimens of cervical epithelium quite similar to goblet cells. Fig. 10 is illustrative of this alteration in the morphology of the cervical epithelium.

#### COMMENT

What we desire to place on record in the present communication is the evidence of remarkable activity of the epithelium covering the cervical canal and its glands during gestation. The data collected by routine examination of 29 specimens of gravid uteri reveal a remarkable difference in degree of the epithelial alterations. Various evidences of epithelial activity, such as reduplication of cell layers, vacuole formation and some vesicular polymorphism of the nuclei were encountered in certain areas of every specimen. It was in 8 cases out of the 29, however, that very representative activity appeared to be present. In this latter group, the principal epithelial variations observed were: epithelial proliferation with stratification; occurrence of mitotic figures in the proliferating epithelium; considerable epithelial downgrowth into the connective tissue; indirect metaplasia; goblet cell formation.

The mode of origin of the epithelial proliferation is of particular interest. In most instances the predominant change consists in the formation of a double or treble layer as a clearly visible manifestation of the proliferation of the surface epithelium. The transition to the single layer may be abrupt, while, on other occasions, gradations through a double layer to the treble layer are found. In some places, there seems to be evidence that nests of basal squamous epithelium which have remained behind the cervical columnar cells, have been

stirred into activity and produce polygonal elements, "infraepithelial cells," which undermine and push up the columnar lining. When epithelial stratification occurs and five or more layers become distinguishable, the epithelium changes its character and takes on the form of cuboidal or transitional cells whose comparatively large nuclei display a great affinity to stains. The proliferating epithelium, with the formation of many layers, may sometimes superficially resemble a change toward the squamous type. As an expression of the more or less rapid multiplication of the cells, mitotic figures may occur during the various months of pregnancy. The formation of several cellular strata frequently results in a distinct invasive character of the epithelium. Occasionally, the amount of such epithelial downgrowth into the stroma may be extreme. Under these conditions, the proliferation may cause resemblance to malignant disease. Definite features, however, distinguish it from cancer. In the first place, there is only slight polymorphism in the size and type of the cells. What is more important, the mitoses are regular and the basement membrane can always be made discernible by appropriate methods. It is well to remember in this connection that in the normal cervical mucosa, the basement membrane is an exceedingly delicate structure, whose demonstration in microscopic preparations calls for a special technique. The hematoxylin-molybden method may be used for that purpose to great advantage. Errors in the diagnosis of biopsies obtained from cervixes of pregnant uteri may occur if the phenomena just detailed are not borne in mind; more particularly since the opinion has been expressed by experienced gynecologic-pathologists that the presence of mitosis in the cervical epithelium should be viewed with the utmost suspicion. "It is almost *prima facie* evidence of cancer" (Cullen).

*The generation during pregnancy of multilayered cells by the proliferating cervical epithelium might be properly designated as epithelial hyperplasia, exhibiting certain features of "metaplasia."*

In casting about for the causative agent of the unique proliferation of the cervical epithelium during gestation, vitamin deficiency was considered first as an etiologic factor. Concerned for some years with the effects of withdrawal of certain vitamins from the female organism, the studies of Wolbach and Howe, Goldblatt and Benischek, Green and Mellanby have established Vitamin A and D deficiency a potential factor of squamous metaplasia of the columnar epithelium in the respiratory and alimentary tract, and also to some extent in the urogenital system. Certain investigators maintain that Vitamin A deficiency may even bear an important causal relationship to cancer development. On the other hand, with the presence of anterior pituitary hormone in the blood of pregnant women established and the occurrence of phenomena of proliferation and of metaplasia of the cervical epithelium in response to an excess of hormonal principle demon-

strated by Hofbauer and Allen, stimulation of this epithelium by the hyperactive anterior pituitary during gestation remains the keynote of our trend of reasoning. It is appropriate at this junction, however, to emphasize our lack of knowledge as to why in certain cases the proliferation of the cervical epithelium is barely noticeable, while in others it represents a prominent feature of the cervical structure in the pregnant woman. Again, it is well to remember that the occurrence of decidua-like connective tissue cells in a certain proportion of the cases under consideration likewise attests to enhanced anterior pituitary activity. It is also interesting to note the growth activity of the tissues which are in immediate contact with the epithelial neoplasia. The occurrence of mitotic figures in the connective tissue elements adjacent to the invading cervical epithelium adds a distinct indication of the processes of active growth in this locality. With all these facts in mind, it is difficult to maintain the explanation offered by Stieve that the alterations in the morphology of the cervical epithelium should be looked upon as the result of stretching of the epithelium by the fetal membranes.

Now arises the fundamentally important question relative to the clinical significance of the complex epithelial neoplasia in the cervical mucosa of the pregnant woman. The foregoing evidence taken as a whole, tends to show that the type of epithelial proliferation described represents a condition *sui generis*. It bears a definite resemblance to the morphologic appearance of epithelial neoplasia in the ducts and acini of cystic mastitis. According to the painstaking studies of Cheate this lesion passes through a series of epithelial events that may culminate in carcinoma of the breast. Alterations in the morphology of the epithelium of the gall bladder, a near parallel to the phenomena seen in the cervix of the pregnant uterus have recently been described by King, who fully discusses the bearing of such occurrences on the etiology of cancer of that organ. The important studies of Schmieden, Ewing and others, showed that in polyposis of the colon, in approximately half of the cases, the lesion which at first lacks malignant attributes may be traced through the various stages of hyperplasia to malignant degeneration. Under these conditions, striking structural changes occur; the rapidly proliferating epithelium piling up into multilayered buds or projecting into the connective tissue matrix, as readily recognizable criteria of the changed morphology. The exact relation of such excessive epithelial activity to the onset of malignancy, it is true, remains a mystery; the nature of the agency responsible for imparting to cells the power of disordered growth still being hypothetical.

There may sometimes be great difficulty in distinguishing in various organs between blastomatous growth of the epithelium and hyperplasia. The fact remains that cells that have once been stimulated to

proliferation are the most likely later to develop malignancy. In a recent illuminating exposition, Oertel presents the mechanism of the phenomena under consideration: "Cancerous growth is preceded by generations of newly formed cells which still carry the characteristics of normal regeneration. The growth of cancer is in every instance a late result of previous tissue changes, which in one instance retains the character of pure cell regeneration (cell hyperplasia) and in the other is followed by the creation of new types of cells, atypical in appearance and character."

In taking up the consideration of the anatomic and histologic changes which are conducive to the occurrence of cancer of the cervix uteri, I shall not attempt to make a full summary. The trauma incident to childbirth and its after-effects in the cervix, lacerations, eversion, erosion, and consequent inflammation resulting in long-continued irritation, have been considered as the exciting causes of the disease, by most observers. Of late, however, considerable doubt has been cast on the correctness or completeness of such reasoning. Martzloff writes: "One is confronted by the inescapable fact that in most instances cancer of the cervix is definitely associated with a history of one or more previous pregnancies. Just what actual influence a previous pregnancy may have on the cervix uteri to render it particularly susceptible to cancer, one cannot satisfactorily answer. Most observers believe that healed cervical lacerations following the inevitable injury to the cervix at childbirth, miscarriage, or manipulations, supply the primordium for cervical cancer. There is, however, no definite proof at hand to show that cervical cancer begins primarily in an old laceration." Bell, even more tersely, remarks: "Erosions and lacerations of the cervix furnish a theoretical point of origin for cancer, but the earliest cancers we have studied did not arise from these lesions. We have no certain knowledge of the inciting causes of cancer of the cervix." In his report on the work of the Cancer Commission of the League of Nations (1927), Sir George Buchanan states: "Although cancer of the cervix uteri is mainly a disease of women who have borne children, the work of the Commission has confirmed the conclusion of Peller and Deelman that it is the *fact of a pregnancy* and not the number of deliveries which is the predisposing factor in the production of cancer of the uterus."

No more comment is necessary to emphasize further the state of confusion and contradiction which prevails in the literature regarding the etiology of cervical cancer. In the light of the cellular alterations which occur in the cervical epithelium during gestation, it might serve our purpose to focus attention on these physiologic facts as possibly relevant to the problem under consideration. This conception, however, although intriguing, is still vulnerable. We do not know at present, how long the hyperplastic cervical epithelium may persist after

the termination of pregnancy. The difficulties of properly assessing and coordinating the findings of epithelial activity in the cervical mucosa when months or years have elapsed after labor, may be exemplified by reference to Fig. 11 which represents an illustrative example of reduplication of the mucosal epithelium in a cervix which had been removed for laceration associated with infection, nineteen months after delivery. There is considerable round cell infiltration in the immediate subepithelial zone of the cervix. Hence, it is conceivable that as a response to the unduly long stimulus of chronic irritation, proliferation and increased cellular activity has set in, while the reduplication of the cervical epithelium might as well be considered a remnant of the gestational processes. Chronic irritation is generally given much prominence in the discussion of carcinogenetic factors, in that it excites cellu-

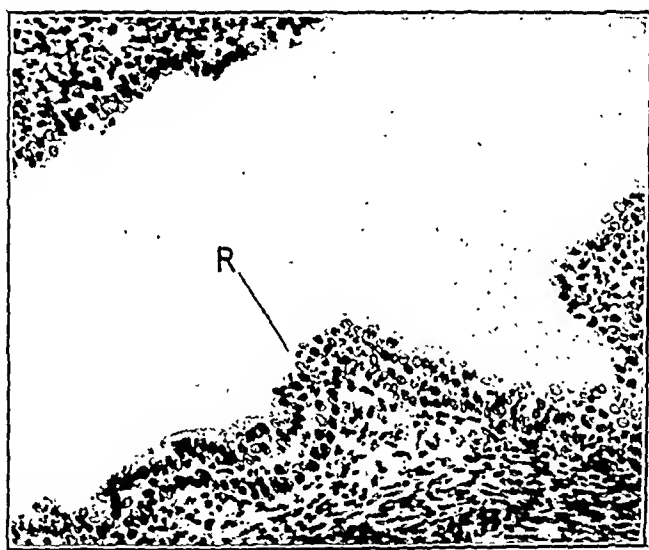


Fig. 11.—Photomicrograph of cervix removed nineteen months after delivery. Note reduplication of epithelium of the cervical canal and round cell infiltration beneath it (endocervicitis). X200.

lar proliferation. Yet, before cancer actually develops, the normal relationships and constellations of the tissues break down, due to some other unknown factor. *It is the change in the character of any proliferating epithelium which has obviously something to do with the liability to malignant growth.*

#### CONCLUSIONS

The morphologic appearances of the hyperplastic changes of the cervical epithelium found in a small but notable proportion of pregnant uteri, with well-defined ingrowths and hyperchromatism, do not enable a dogmatic statement to be made upon its significance as a primordium of or an antecedent to cervical cancer. No conclusive sequence of events from this remarkable epithelial hyperplasia into genuine can-

cer has as yet been observed. Reasoning by analogy, however, with similar phenomena in the gall bladder, the breast and the alimentary tract on record, I venture to suggest that the production during pregnancy of solid tongues of proliferating epithelial cells in discrete places of the cervical mucosa, whatever their fate, may represent an important link in the chain of causative factors for the later development of malignancy, leaving unanswered the question of the interrelation of such epithelial variations and sequential chronic inflammatory conditions. From these considerations the practical lesson may be drawn that as an important element in cancer prophylaxis proper care of the endocervix in the postnatal clinic requires emphasis on careful inspection and immediate attention to any vascular or granular area in its substance.

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Among 30,000 deliveries there were 266 cases of eclampsia and preeclampsia (0.9 per cent). The total maternal mortality was 8.2 per cent but it was 9.3 per cent for the 236 patients who had convulsions. There were no deaths among the 30 women who had preeclampsia. The fetal death rate among those with eclampsia was 17.7 per cent and among those with preeclampsia it was 36.6 per cent. Of the 236 eclamptic patients 64 delivered spontaneously (27.1 per cent). Of the remainder, 113 or 47.8 per cent were delivered vaginally and among these were 13 vaginal cesarean sections. Of the 77 women delivered with forceps 3 died, of the 23 delivered by version 2 died and of the 13 delivered by craniotomy, 2 perished. Of the 13 women on whom a vaginal cesarean section was performed 6 died. There were 45 abdominal cesarean sections in the series (19 per cent) and seven mothers died (15.6 per cent) and seven children were lost. On the other hand, of the 191 women treated conservatively 15 mothers died (7.8 per cent) and 35 babies perished (18.3 per cent).

The author concludes from his study that under similar conditions the modified active treatment yields the same results as the purely active therapy. In the most serious cases abdominal cesarean section does not help any more than the other methods.

J. P. GREENHILL.



# THE TOXIC PSYCHOSES OF PREGNANCY AND THE PUERPERIUM\*

LEON S. MCGOOGAN, M.D., OMAHA, NEB.

(From the Department of Obstetrics and Gynecology, University of Nebraska College of Medicine)

**S**TUDENTS of psychiatry interested in the problem of psychoses during pregnancy and the puerperium have definitely established the facts that these psychoses, like all other psychoses, are caused by a multiplicity of factors; that pregnancy and childbirth may give rise to purely functional psychoses that are psychogenically conditioned; and that there is no psychosis that is definitely and solely related to the phenomena of reproduction.

The classification by the different psychiatrists of the various types that appear is fairly uniform. The three main varieties are: (1) the toxie-infectious; (2) the manic depressive; and (3) the schizophrenic. Some writers have also included paresis and the psychoneuroses with psychotic symptoms. This paper deals only with the toxie-infectious type of psychoses.

During the fifteen years in which the University Hospital of the College of Medicine of the University of Nebraska has been in existence, a variety of cases of toxic-infectious psychoses during pregnancy and the puerperium have been observed. Some of the cases were admitted to the neurologic service and some to the obstetric service, but in all cases the treatment has been carried out under the supervision of the combined departments.

## CASE REPORTS

*A. During Pregnancy.*—Four cases of toxic neuronitis with a psychosis resembling that described by Korsakoff have been observed. These cases have been reported by me<sup>1</sup> in a recent communication and will not be further described here. The psychosis in these cases is undoubtedly toxic in origin and in some way related to the toxic vomiting which always precedes the onset of the mental and peripheral nerve phenomena. As yet the source of this toxin is unknown but it probably arises as a result of a metabolic process. Only one of these patients recovered, the other three cases terminating fatally.

**CASE 5.**—University Hospital No. 24002. The patient was admitted the first time on Oct. 31, 1927. She was twenty-nine years of age, white, housewife, and complained of roaring in the head and the hearing of strange noises.

The patient was born in Nebraska. She completed the seventh grade at school at the age of twelve. She had no particular difficulties and got along well with her classmates at school. She left school because of illness at home, and to help care for the family. She later worked as a clerk, waitress, cashier, and at other odd

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jobs. Her work had always been satisfactory. While working as a waitress, the year prior to her marriage she was shadowed and followed several times by a negro. She reported this to the police and was allowed to carry a gun. A short time prior to the onset of her illness a friend told her that this man was in the city in which she was then living. Some of her hallucinations were concerned with the hearing of shots and voices calling her a negro lover.

The patient had been married for eight years. The husband and wife were very congenial and the sexual life had been entirely satisfactory. She had had two pregnancies, both were normal, and the last one had terminated two years prior to her admittance to the hospital.

There were never any day dreaming tendencies. The patient had always been a good mixer and enjoyed having people about her. She had never expressed any feeling of inferiority, self-depreciation, or ideas of persecution.

The family history was negative for alcoholism or insanity.

The patient had apparently been well until December, 1926, ten months prior to her entrance, when she had scarlet fever. She was very ill at this time and was delirious for four days. From that time on she had hallucinations of an auditory character. In May, 1927, she had a spontaneous abortion at the third month of gestation and in July conceived again. During the entire summer and up to the day of admission the patient continued to have auditory hallucinations. She developed insomnia, worried much, and complained of the roaring sensation in her head and the hearing of voices mentioned above. She had lost 25 pounds in weight in ten months.

The physical examination showed considerable loss of weight and except for the pelvic examination was entirely negative otherwise. On bimanual examination the uterus was found to be about the size of three months' gestation.

After one month of palliative treatment and failure of the uterus to enlarge and of the psychosis to lessen, an evacuation of the uterus was performed, removing a fetus, undoubtedly dead for some time, appearing to be slightly under a three months' gestation.

The patient improved slowly and was dismissed Dec. 17, 1927. She continued to improve at home and regained 10 pounds of weight. On April 11, 1928, the roaring sounds in the head reappeared and were associated with insomnia and auditory hallucinations. She was readmitted to the hospital April 15, 1928. The general physical examination again was negative except for the pelvic findings. The uterus was enlarged to about the size of a three months' pregnancy. The patient had evidently conceived shortly after being dismissed from the hospital.

On April 25, 1928, an abdominal hysterotomy and bilateral salpingotomy was performed. She made an excellent recovery from the operative procedure and was dismissed on May 5, 1928, with all hallucinations absent and without any other phenomena of her psychosis. She had an excellent insight into her condition.

*Diagnosis:* Schizophrenic reaction with delirious features.

*B. During the Puerperium.*—CASE 1.—This case like the first four cases reported above was a case of Korsakoff's psychosis and occurred following a therapeutic abortion for pernicious vomiting. It has also been previously reported.<sup>1</sup>

CASE 2.—University Hospital No. 28064. The patient was admitted on March 24, 1929, on the eighth day after delivery. She was white, twenty-six years of age, and married.

The family history was negative.

The patient had been born in Nebraska, and was one of a family of eight children. She finished the eighth grade of school and made good grades by hard study. She stopped school to nurse her mother who was seriously and chronically ill. She

later began a preparatory course at a normal school but was forced to quit because of nervousness brought about by study and working in a home for her board.

When she was twenty-two years of age she worked in a physician's office. During the following year she had a very serious love affair which was terminated by the sudden death of the young man. Subsequently she married at twenty-five and her husband stated that the marriage had been a perfectly happy one. He and her mother both agreed that the patient was not unduly sensitive, that she made social contacts easily and had no day dreaming tendencies.

The patient became pregnant during the second year of her marriage. The pregnancy was entirely uneventful and on March 5, 1929, she delivered her child after a ten-hour labor. The puerperium was entirely normal until the eighth day. On the evening of the seventh day the husband of another patient in the ward came to see his wife. That night the patient dreamed that this man had stolen her baby. The next day she was irrational. She was certain that her baby had been stolen and told her husband that he should have stayed at the hospital during the night, like the other husband.

She was admitted to the University Hospital, presenting great psychomotor activity and begging her husband to take her home. She talked and sang incessantly. There were flights of ideas but they centered about her family, particularly her husband and child. She also had hallucinations of an auditory and visual nature.

On admission the general physical examination was entirely negative.

The temperature was 100.6°. The urine was normal. The blood Wassermann reaction was negative. The blood hemoglobin was 90 per cent (Sahli), the erythrocytes 5,440,000, and the leucocytes were 12,200 per c. mm. A differential count showed 72 per cent polymorphonuclear cells.

The patient was in the hospital one month during which time she showed little or no improvement. She was dismissed against advice to go to her home.

The patient on Aug. 10, 1932, reported that she did not fully recover until one year after her dismissal, but during the past year she has been in good health. There have been no other pregnancies.

*Diagnosis:* Manic reaction with delirious features of hallucinosis.

CASE 3.—University Hospital No. 7741. Patient, white, thirty-three years of age, was admitted to the hospital March 3, 1922, in labor. The present pregnancy, the sixth, had been normal throughout as had the previous pregnancies.

Labor was uncomplicated, and she delivered herself spontaneously of a normal male child. The puerperium was uneventful until March 6, on which day she complained of severe lower abdominal pain and headache. A general physical examination was negative except for considerable tenderness over the uterus. Temperature 104.2° F., and pulse 140. Leucocyte count, 14,800, 88 per cent polymorphonuclears. The urine examination was essentially negative. The patient's symptoms continued and there also developed some pain in the lower back. On March 11 she passed a small blood clot and on March 12 she passed about 400 c.c. of old clotted blood and some shreds of fetal membranes. She then had a severe generalized chill following which she became markedly disoriented. An examination of the urine on that day showed the presence of a small amount of albumin and many hyaline casts, leucocytes, and a few red blood cells. During the next two weeks the patient continued to have chills and fever and marked mental confusion and disorientation. The uterus slowly involuted and the urine continued to contain large numbers of pus cells. The patient was removed from the hospital against advice on March 26 only slightly improved, but subsequently made a complete recovery.

*Diagnosis:* Pregnancy, subinvolution, pyelitis, toxic psychosis.

CASE 4.—University Hospital No. 25812. Patient, white, twenty-seven years of age, a tertigravida, was admitted June 25, 1928.

Last regular menses Nov. 30, 1927. The pregnancy had been entirely uneventful until June 21, 1928, at which time she noticed some soreness in the throat upon swallowing; and fullness in the epigastrium upon taking food. She took no food therefore except milk. On the day prior to admission she became nauseated and vomited; at one time the vomitus contained some bright red blood. She went into labor on June 27 and after a short labor was delivered of a seven-month premature stillborn female child. During the delivery the patient was very excited and claimed she had a confession to make. The nature of this "confession" was never learned as the patient disclaimed all knowledge of it later.

Following the delivery the patient continued to have difficulty in swallowing, and continued to be nauseated and to vomit. On the evening of June 30 the patient became irrational with auditory and visual hallucinations. On the next day the temperature was 103° and the pulse 130. A white blood count showed 13,000 leucocytes. On July 3 the mental confusion had entirely disappeared and the temperature was 100°. The general physical examination during this period had been entirely negative except for a continued subinvolution of the uterus with some pain over the uterus upon deep palpation. The lochia which had been scanty had a very foul odor.

The patient rapidly improved, the temperature became normal, the uterus involuted and the patient was dismissed on July 7.

*Diagnosis:* Pregnancy, premature labor, stillborn fetus, sapremia, toxie psychosis.

CASE 5.—University Hospital No. 31729. Patient, a secundipara, aged twenty-nine, was admitted on May 2, 1930. Her maternal grandmother and one maternal aunt had suffered from a puerperal psychosis.

The patient's pregnancy had been entirely normal and she had delivered herself ten days prior to entrance to the hospital without difficulty. The puerperium was entirely uneventful until the fourth day, at which time the patient developed great psychomotor activity and auditory and visual hallucinations.

On admission physical examination was negative except for the pelvic findings. The fundus uteri reached about halfway to the umbilicus. There was a very foul smelling, dark red colored vaginal discharge. The temperature was 100° and pulse 88. The blood showed 14,000 leucocytes with 85 per cent polymorphonuclear cells.

The temperature slowly subsided, the uterine infection slowly lessened and the mental phenomena gradually disappeared.

The patient was dismissed on July 7, 1930, apparently fully recovered and with a good insight into her condition.

*Diagnosis:* Pregnancy, uterine infection, toxie psychosis.

CASE 6.—University Hospital No. 34267. Patient, a primigravida, nineteen years of age, was admitted on Feb. 7, 1931. Last regular menses commenced on May 7, 1930. The pregnancy had been entirely normal until February 5, when the patient had a generalized convulsion following which she developed considerable edema of the hands, face, and feet. She had four more convulsions and was admitted to the hospital in a semicomatose condition. There was marked peripheral edema; the blood pressure was 160/100 and the urine contained 2.5 gm. of albumin per liter. The Stroganoff course of treatment for eclampsia was carried out for twenty-four hours and at the end of this period she seemed to be somewhat worse. A classical cesarean section was done and a living female child delivered.

The patient improved following the delivery, the blood pressure became lower, the mental torpor disappeared, but the edema persisted. On February 11 the

later began a preparatory course at a normal school but was forced to quit because of nervousness brought about by study and working in a home for her board.

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Following the delivery the patient continued to have difficulty in swallowing, and continued to be nauseated and to vomit. On the evening of June 30 the patient became irrational with auditory and visual hallucinations. On the next day the temperature was 103° and the pulse 130. A white blood count showed 13,000 leucocytes. On July 3 the mental confusion had entirely disappeared and the temperature was 100°. The general physical examination during this period had been entirely negative except for a continued subinvolution of the uterus with some pain over the uterus upon deep palpation. The lochia which had been scanty had a very foul odor.

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The patient improved following the delivery, the blood pressure became lower, the mental torpor disappeared, but the edema persisted. On February 11 the

temperature which had been normal rose to 102° (rectal) and on the following day the patient became irrational with delusions and hallucinations. The lochia was foul smelling and the abdominal wound clean. The temperature reaction continued reaching 104° on February 17 on which day a leucocyte count showed 12,800 cells. An abscess of the right vulvovaginal gland developed and drained spontaneously on February 22, following which the temperature slowly abated and the mental symptoms disappeared. The patient was dismissed from the hospital March 7, 1931, in excellent condition.

*Diagnosis:* Pregnancy, eclampsia, sapremia, vulvovaginal abscess, toxic psychosis.

CASE 7.—University Hospital No. 37101. Patient, a tertigravida, white, twenty-eight years of age, was admitted on Nov. 26, 1931, at term but not in labor. On December 11, 1931, a medical induction of labor combined with artificial rupture of the membranes was done, and the patient delivered herself spontaneously of a normal male child. On the following day the temperature was 104.2° and there was some tenderness over the uterus. On December 15 the patient developed auditory and visual hallucinations with ideas of persecution. The hemoglobin was 80 per cent (Sahli), erythrocytes 5,400,000, and the leucocytes 13,000, with 75 per cent polymorphonuclears. The temperature slowly abated but suddenly reached 103° on December 21. On December 22, blood showed 24,400 leucocytes with 90 per cent polymorphonuclears. A general physical examination of the patient revealed only a subinvolution of the uterus which was slightly tender. The lochia was profuse and had a very foul odor.

The symptoms slowly disappeared, and on Jan. 27, 1932, the patient was apparently fully recovered. On that day a perineorrhaphy and bilateral salpingotomy were performed. The patient had a recurrence of her mental symptoms twenty-four hours after the operation, but in a much milder form. She made, however, a fairly rapid recovery and was dismissed from the hospital on Feb. 19, 1932.

*Diagnosis:* Pregnancy, sapremia, toxic psychosis, with recurrence postoperative.

CASE 8.—University Hospital No. 37765. Patient, a secundigravida, white, American, twenty-eight years of age, was admitted on Jan. 30, 1932, in labor.

She had her first child in 1930. She did not menstruate at all following the delivery but conceived the second time some time in April of 1931. A short time later the husband was sentenced to the state prison for theft, this being his third offence of such a character. The patient tried to keep this knowledge from her family and attempted to continue working in the packing plant to support herself. She lived with her husband's family and to them never seemed morose or despondent although the dispensary staff noticed that she seemed unusually reserved and slightly morose. The patient was moderately alcoholic.

During the delivery the patient was very uncooperative. The puerperium was uneventful until February 6 when she accused the nurses of having burned her baby and threatening her with bodily harm. The following day the temperature was 100.5°, and it reached its peak of 102° on February 8. The leucocyte count was only 9,800 with only 58 per cent polymorphonuclear cells. Slight tenderness over a slightly subinvolved uterus.

The temperature slowly subsided, the lochia became very malodorous and the mental disorientation disappeared on February 15. The patient was dismissed on March 2, 1932.

*Diagnosis:* Pregnancy, intranterine infection, toxic psychosis.

## ETIOLOGY

(a) Hereditary factors. A familial history of mental aberrations is present in only one instance. Ellery<sup>2</sup> emphasizes the fact that in all of the psychoses associated with puerperium there is an inability to satisfactorily interview the members of the family because of the "false sense of shame which many still attach to familial insanity, keeping their psychotic skeletons in the cupboard of secrecy."

(b) Health, previous, during and following gestation. As in all types of psychoses the patient's health is an important factor. The presence of infectious diseases, anemias, menstrual disturbances, rapidly repeated pregnancies or toxemia may be the exogenous factor of exhaustion or toxemia which leads to the mental breakdown. In 5 of the patients there was an associated pernicious vomiting. In one case there was a missed abortion followed by two rapidly repeated gestations. In 7 cases there was a postpartum infection. Pylitis was present in one case, intrauterine infection in 5 cases and eclampsia with vulvovaginal abscess and intrauterine infection in the remaining case.

The mental adjustment of the patient to her pregnancy and her social and economic environment is as important as her physical health. Fears and worries lay the groundwork for physical ill health and mental aberration.

(c) Personal make-up. The personality pattern of the individual is of extreme importance. A normal stable individual with febrile toxemia may show no delirium while the psychopathic type with the same intoxication will show a toxic psychotic reaction.

*Parity.*—Multiparas are apparently more subject to the development of a toxic psychosis than are primiparas. Four of the 13 patients were primiparas and 9 were multiparas. Rapidly repeated pregnancies with their resultant morbidity and exhaustion may in some cases as in Case 5 of the intranatal group play a most important rôle.

*Frequency.*—Zilboorg<sup>3</sup> in a tabulation of reports covering 10,000 cases of psychotic women showed that 8.7 per cent belong to the pregnancy group. Various reports from institutions of psychiatry have shown that the toxic infectious group of psychoses constituted 32 per cent,<sup>4</sup> 36 per cent,<sup>5</sup> 34 per cent,<sup>6</sup> and 48 per cent,<sup>2</sup> respectively. Because the figures are so nearly similar for institutions of psychiatry these percentages are undoubtedly correct. On the other hand they do not give the true frequency, because there are no doubt many cases which are so short of duration or so light in character that they do not require institutional care. The actual frequency therefore must be somewhat greater. There are no available reports from any of the large obstetric hospitals or clinics on this subject.



*Period of Incubation.*—There is no definite period of incubation; the severity of the precipitating factor and the resistance of the brain determine the onset. In Strecker's<sup>6</sup> series of cases which were all puerperal and all institutional, the average number of days from the date of delivery to the day of the onset of the psychosis was 22. In the present small series of puerperal cases the average number of days was seven.

*Symptoms and Diagnosis.*—Alterations in the sensorium are distinguishing features of the toxic delirious reaction. In cases due to infection the presence of a rise in temperature, leucocytosis, and other signs of infection are aids in the diagnosis, while in pure toxemic cases, the physical and laboratory signs are guides. One must of course exclude the other types of psychoses, and the differential diagnosis is well discussed by Strecker<sup>6</sup> and Zilboorg.<sup>7, 8</sup>

*Treatment.*—Prior to delivery the obstetric care per se is to be carried out as is indicated by the physical signs. Whether or not to empty the uterus will have to be determined in each individual case. It is generally believed that in those cases of hyperemesis gravidarum which develop peripheral neuritis and a psychosis therapeutic abortion is of no avail. In those cases in which the fetus has died in utero, there is of course no question as to the advisability of emptying the uterus.

During the pregnancy and the puerperium the psychosis should be treated as any other toxic psychosis with absolute rest and quiet, copious elimination, mild sedation, and elimination and treatment of the causative factor.

Higgins<sup>9</sup> in 1914 pointed out that when the psychiatrist sees the patient the damage has been done and that it is the duty of the obstetrician and general practitioner to carefully study each patient, as to her inheritance, her past history, and her reactions to her pregnancy. He should be on guard for the appearance of the early signs of an impending mental break. Too many times in the past the obstetrician has lightly passed over or entirely disregarded the early symptoms, been confounded at the outbreak of a psychosis, and then disclaimed any responsibility for its occurrence. It is as important to be acquainted with the early indications of an impending psychosis as it is to be versed in the early signs and symptoms of a toxemia of pregnancy.

Strecker<sup>6</sup> strongly emphasizes the fact that "much of the therapeutics of the psychoses of the puerperium is embodied in the prevention which will result when serious attention is given to the mental needs of the pregnant woman." He rightly claims that "it is as much a part of the duty of the . . . practitioner to modify or resolve these difficult situations (i.e., misconceptions of childbirth, apprehension, worry, family misunderstandings, loss of beauty, etc.) as it is to have the urine tested."

Women with known psychotic tendencies, or those who are physically below par, or who develop an intercurrent infection or a toxemia of

pregnancy should be carefully watched. Any symptom such as insomnia, prolonged anxiety, physical or mental exhaustion, or change of character should arouse suspicion of an impending psychosis and treatment should be instituted.

Women who have had and suffered from a previous attack of toxic infectious psychosis should be urged not to attempt another pregnancy. Even as a contracted pelvis and general systemic diseases make a woman ineligible for pregnancy if she wished to enter it with impunity, so should mental disease even though the phenomenon is less apparent and tangible. The practitioner and specialist must as Ellery has stated "give enlightenment to the ignorant, and sage counsel to those whose erring impulses may be leading them along the pathways of misery."

*Prognosis.*—The course of the disease varies from a few days or several weeks to several years or even to permanent dementia. In the Korsakoff type associated with hyperemesis gravidarum, the prognosis is poor as to life and as to ultimate recovery<sup>1</sup>; 80 per cent of our patients died. Of the remaining cases, due to other causes all recovered. Strecker reports 76 per cent recovery and Ellery 49 per cent recovery, and 18 and 33 per cent respectively of their patients were permanently demented, while the remainder terminated fatally.

The condition may recur during a subsequent pregnancy as is shown in Case 5 of the intranatal group.

#### SUMMARY

1. Thirteen cases of toxic psychoses during pregnancy and the puerperium are presented with an effort to point out etiologic factors.
2. Familial insanity, the individual's personality pattern, and her previous or present medical or obstetric morbidity are most important.
3. There are no available reports as to the actual frequency of this complication.
4. More attention must be given to the mental needs of all women entering pregnancy.
5. The obstetrician must familiarize himself into the underlying factors of a psychosis, and recognize the early signs and symptoms in order to institute prophylactic treatment.

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## ETIOLOGY OF PROLAPSE\*

ERWIN VON GRAFF, M.D., IOWA CITY, IOWA

*(From the Department of Obstetrics and Gynecology, State University of Iowa)*

OBSTETRIC traumas, including lacerations of the soft parts, overdistention of the muscular, fascial, and ligamentous "fixation apparatus" of the vagina and uterus, are commonly looked upon as paramount in the development of uterine descent and prolapse. In addition, great importance has been attributed to retrodeviation of the uterus as a predisposing factor.

The serious study of procidentia was undertaken many years ago for the purpose of correlating changes in the tissues and in the local anatomical topography with the actual conditions which finally lead to the development of prolapse.

Martin, in Berlin, emphasized the fascial and ligamentous apparatus as the chief factor in the normal topography of the female genitalia, while Tandler and Halban held the opinion that the muscular pelvic floor was more important. Credit should be given to E. Wertheim, who spent more than twenty years in the development of the operative treatment of prolapse, for first recognizing and pointing out, more than any other author, that the muscular floor and the connective tissue are of equal importance. The work of these men, and that of T. J. Watkins, in this country, covers all the necessary anatomical information, and has been fundamental in the development of the various successful methods of operative repair, but has not disclosed the etiology of prolapse.

It must be admitted that usually, but not always, prolapse is found in women who have had at least one child; but I have felt for many years, that "birth trauma" and movable retroflexion of the uterus do not alone determine the development of prolapse. Two women, who as frail, slender girls, have lived and grown up under the same environment, may become pregnant and have normal deliveries. The one "blossoms out" following parturition and becomes a fully efficient and healthy mother and woman; the other remains weak, never overcoming the strain of childbirth, and soon develops enteroptosis and prolapse. This entirely different behavior is an expression of varying ability to respond to the same physiologic event, of an inherent "constitution," definitely determined for each individual at the moment of fusion of its parental germinal cells.

\*Read at the Fourth Annual Meeting of the Central Association of Obstetricians and Gynecologists, Memphis, Tenn., September 15-17, 1932.

That delivery acts merely as an initiating factor, favoring the development of descensus and prolapse, is evidenced by many women who do not show the slightest derangement following ten or more deliveries; while, on the other extreme, nulliparous women, even virgins, occasionally develop varicosities, feeling of "bearing down," and marked degrees of prolapse.

Whether or not prolapse develops is primarily dependent upon the individual constitutional disposition, i.e., upon the functional efficiency or inefficiency of the mesodermal structures, such as connective tissue, fascia, and muscle. Stiller and P. Mathes first recognized that group of women with all the characteristics of congenital weakness and loose-

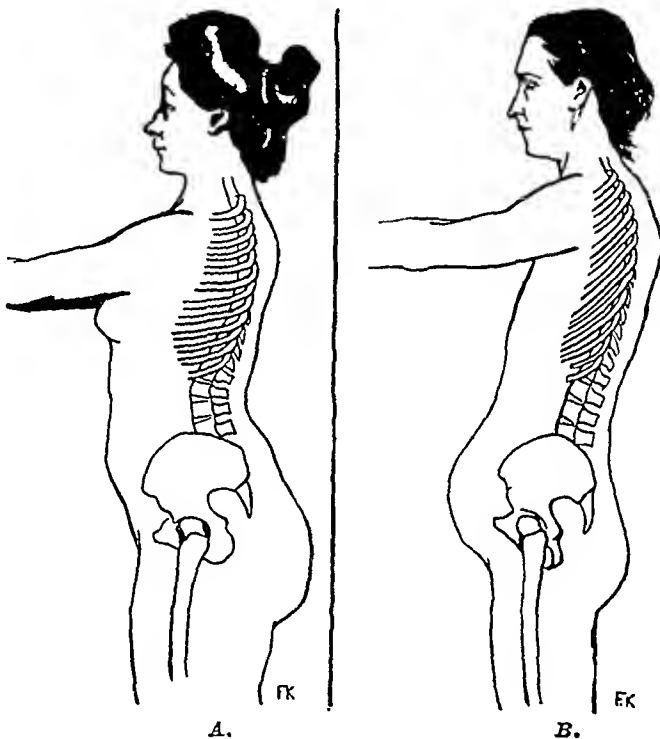


Fig. 1.—A, "Pyknika," the ideal type for reproduction. B, "Asthenico-ptotic" type. (Mathes.)

ness of the mesodermal tissues, who are more likely to pay for motherhood with procidentia, and designated them as the "asthenico-ptotic" type.

In very marked cases, this type of woman may easily be recognized on first sight (Fig. 1 B). The shoulders are sloping, the thorax flat, the ribs join the vertebrae at acute angles, the abdominal wall is lax and protrudes below the umbilicus, being unable to resist the pressure of the enteroptotic viscera. The facial expression is often shy, anxious, and mournful, while the psychic condition is characterized by "lack of pep," poor self-control, and lability, with sudden changes of temper from unnatural vivacity to melancholia. In addition to this fully developed type, there are many minor degrees of asthenico-ptotic con-

stitution, which are concealed under perfectly normal appearance, and can be recognized only by the discovery of enteroptosis, movable retroflexion of the uterus, varicose veins of the lower extremities, and labile temperament.

It is interesting, as evidence of a changing concept of female beauty, to note that at the time of primitive Christian art under the old Roman Empire and at the height of the Italian Renaissance in the fifteenth century, the ideal type of woman approached that which we designate as asthenico-ptotic, and which is now recognized as poorly adapted to childbearing.

Besides the asthenico-ptotic constitution, we find that the intersexual, virile woman, the boyish, frail, and slender girl, as well as the acromegalic, masculine woman, is less apt to fulfill the demands of reproduction without lasting damage, although they may often be otherwise outstanding in their intellectual capacities and most desirable companions in marital life. As a third predisposing factor, constitutional endocrine disturbances may be mentioned, although as yet they are little understood.

Finally, localized reduction of the strength of the muscular support of the pelvic floor incident to an occult spina bifida, must be considered in every prolapse occurring in a nulliparous woman.

The genuine, primitive, pure woman known as the "pyknik" type has far the best chance to tolerate even a large number of deliveries with perfect involution and restitution of the genitalia.

If it is true that the development of prolapse depends upon individual constitution, we may expect to find, according to the different functional efficiency of the structures derived from the mesodermal tissue, four groups of women suffering from prolapse.

1. Virgins and nulliparous women with prolapse, often stigmatized by: occult spina bifida, varicose veins, enteroptosis, movable retroflexion of the uterus, asthenico-ptotic or virile intersexual appearance, or endocrine obesity.

2. Women who have developed prolapse soon after the first delivery may also show the above stigmas. These two groups include individuals with definitely inefficient connective tissue, and a constitutional inferiority with regard to reproduction.

3. Women in whom symptoms of prolapse have appeared, often many years after the last delivery, at the *climacteric* age (by far the largest group). All these women have a moderate degree of tissue weakness which becomes manifest only by the additional loss of elasticity of the connective tissue, appearing at the time of physiologic involution (*climacteric* age).

4. A comparatively small group of women whose prolapse has developed only *after the menopause*. As they went undisturbed through the climacterium, their tissue function may be considered as almost normal.

In order to support this conception by statistics, over a considerable period of time, all new patients were carefully examined, paying especial attention to the condition of the pelvic outlet, recording even the

slightest degree of relaxation. In this way, 800 women, each of whom has had at least one child, have been reviewed. Besides, 26 nulliparous women were seen, with more-or-less marked relaxation and prolapse.\*

#### I. PROLAPSE IN NULLIPAROUS WOMEN

The 26 women of this group varied in age from seventeen to sixty-nine years. More than half of them, however, were over thirty-six years of age. This shows again that in an individual with constitutionally poor tone of the connective tissue, the additional physiologic relaxation which comes with advanced years, is likely to favor the development of descensus, regardless of whether or not the woman has borne a child.

Most of the patients had no subjective symptoms, and the relaxation was merely an accidental finding. Eight of these women, however, had come to the clinic because of a "bearing down feeling" or the sensation of a foreign body in the introitus, and backache; in seven of them, operation was found necessary. Four are of especial interest, because occult spina bifida was suspected, and x-ray pictures of the sacrum were taken. In two cases the x-ray pictures were distinctly positive (Cases 1 and 3), in one case suspicious (Case 4), and in one case negative.

CASE 1.—J. K., aged twenty-four years, white, married for six years, no pregnancies, believed to have been operated upon immediately after birth for anal atresia. Has never been seriously sick. Menstruation normal. At sixteen years, obstinate constipation and a feeling of "bearing down" with frequent micturition were noted. Examination showed an almost complete prolapse of the vagina with enormous elongation of the cervix. Suspension of the cervix by the sacrouterine ligaments, and vaginal fixation of the uterus were performed at this time, but the operation was followed by complete return of the prolapse during the following year. Physical examination: Patient's height 59.2 inches (148 cm.). Hair distribution and mammae normal. Horizontal broad shoulders, comparatively small hips. The thighs did not touch in the midline and lacked the female softness and rounding: husky masculine intersexual type. X-ray of the sacrum shows a defect in the arch of the first sacral vertebrae (Fig. 2), although palpation was negative. The operation performed at this time consisted of a thorough colpo-perineorrhaphy and complete obliteration of the deep, relaxed Douglas pouch from above. An enormous dilatation of the transverse colon was found, and an incomplete descensus of the ovaries, both located above the innominate line. Two years later the patient was admitted for a third time complaining of constipation which might last as long as four weeks. There was no return of the prolapse. The abdomen was slightly distended by a plastic soft tumor occupying the entire abdominal cavity, which decreased markedly in size, in one week, after twenty-one copious bowel movements of about fifty pounds of feces. As the patient felt otherwise well, and was satisfied with the result of the former operation for the correction of prolapse, no further therapy was offered.

CASE 2.—F. H., Hosp. No. E6273, aged thirty-six years, white, married for sixteen years, no pregnancies, complained of a prolapse of the vagina which appeared

\*The data from 800 women have been collected by the author from his service at the Second Frauenklinik at Vienna. A portion of the 26 nulliparous women has been seen in Vienna and part in the Department of Obstetrics & Gynecology, University Hospital, State University of Iowa.

fifteen years ago and had become worse during the last year. Physical examination: woman of normal female appearance, but unusually stout, with a cystocele the size of an orange. X-ray examination of the sacrum showed normal conditions. Operation: vesicovaginal interposition of the uterus according to Wertheim.

CASE 3.—C. S., Hosp. No. G985, aged thirty-seven years, white, married for fourteen years, had never been pregnant. Onset of menstruation at age of fifteen, regular twenty-eight-day cycle with three to eleven days' duration. Present complaint: attacks of pain in lower abdomen for past several years. Findings: large, obese woman, who looked markedly older than her age; height 63 inches (157.5 cm), weight 149 pounds (64 kilo). Bimanual examination: chronic salpingitis, fibroids of the uterus, wide "virginal" outlet, the hymen intact but markedly stretched. When the patient strained, the anterior and posterior vaginal walls bulged through the vulva (Fig. 3) and the cervix could be felt within an

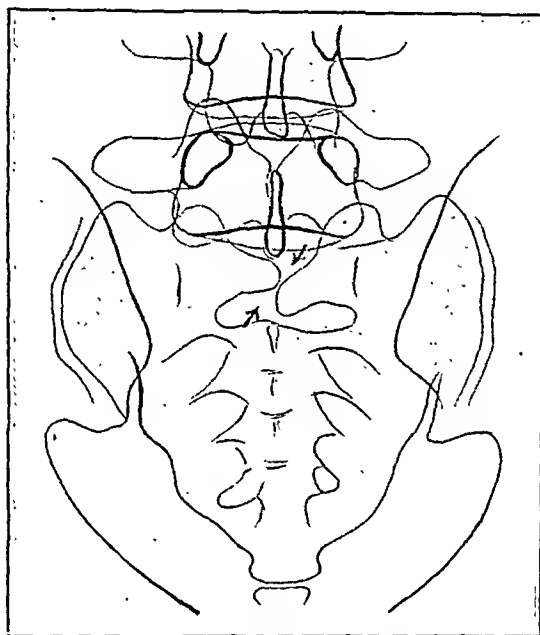


Fig. 2.—(Graff). Occult spina bifida (case 1).

inch of the introitus. The findings aroused the suspicion that the prolapse might be associated with some malformation of the sacrum and an x-ray picture showed a very distinct defect in the arch of the first sacral vertebra (Fig. 4).

CASE 4.—S. M., Hosp. No. E6774, aged twenty-five years, white, married for two years. No pregnancies. Onset of menses at eighteen years; irregular. The chief complaint was that, for the past ten years, the cervix had occasionally protruded through the introitus. For the same period of time, the patient had suffered from headaches, easy fatigability, and a feeling of "bearing down." Findings: Obese woman 62½ inches (156.2 cm.) tall, weighing 162 pounds (70 kilo), with normal hair distribution. Bimanual examination revealed a very wide relaxed outlet with unlacerated hymen which allows the protrusion of the anterior and posterior vaginal walls when the patient strains. The uterus is hypoplastic, hyperanteflexed, and can easily be pulled down almost to the introitus. X-ray examination of the sacrum did not show the expected spina bifida but an unusually wide foramen between the last lumbar and first sacral vertebrae (Fig. 5). Colpoperineorrhaphy was performed.

In addition to these four nulliparous women with prolapse—remarkable because of the early development of the condition (Case 1 at seventeen, Case 2 at twenty-one, Case 4 at fifteen years of age), and its association with occult spina bifida (Cases 1 and 3), I want to



Fig. 3.—Prolapse of both vaginal walls. Nullipara, aged thirty-seven, with occult spina bifida (Case 3).



Fig. 4.—Occult spina bifida (Case 3, see Fig. 3).



present another patient with occult spina bifida, who had no prolapse, but who showed a very similar constitution and appearance.

CASE 5.—I. W., Hosp. No. G2434, aged nineteen years, white, single, nulliparous. Menstrual onset at fourteen years; menses irregular. Chief complaint: yellowish discharge and pain in the lower abdomen. Findings: Short, stocky, rather stout woman with broad, virile shoulders and dark complexion. The lower part of the

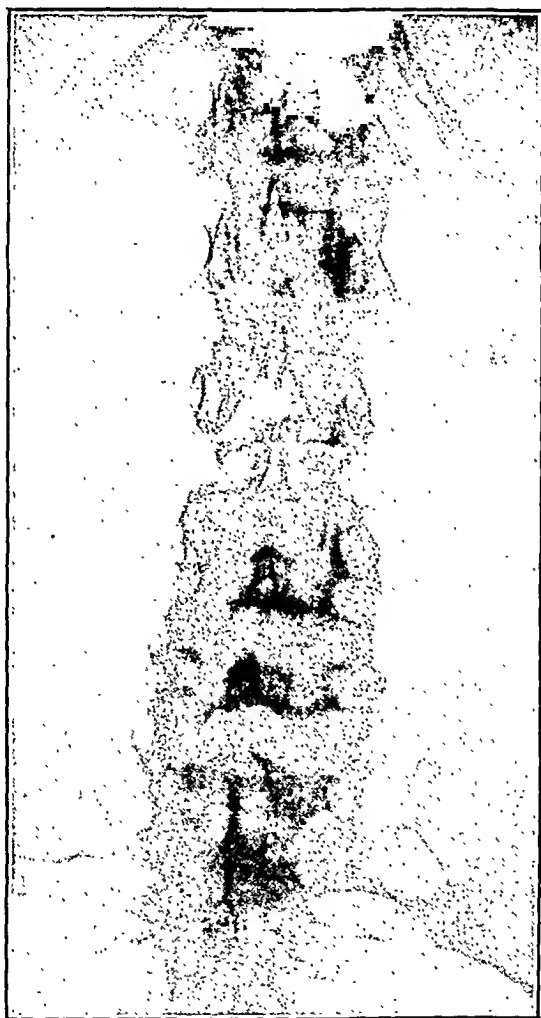


Fig. 5.—Nullipara, aged twenty-five, with prolapse of vagina and abnormally wide intervertebral space. (Case 4.)

abdomen, the entire perineum and the thighs were heavily covered with dark hair. The uterus was small, in acute anteversion, the fallopian tubes swollen and very tender. X-ray examination of the sacrum (Fig. 6), showed a distinct occult spina bifida.

This patient should be mentioned since she seems to show, that, although spina bifida is frequently associated with flabbiness and weakness of the pelvic floor and favors the development of prolapse, it is not the only cause. Moreover, the appearance of procidentia in these

women is to a certain extent also dependent upon a general functional inferiority. It is probably not without significance that this patient with hypertrichosis, broad shoulders and heavy build, belongs to the masculine, intersexual type. It is to be expected that this girl will develop a prolapse soon after her first delivery.

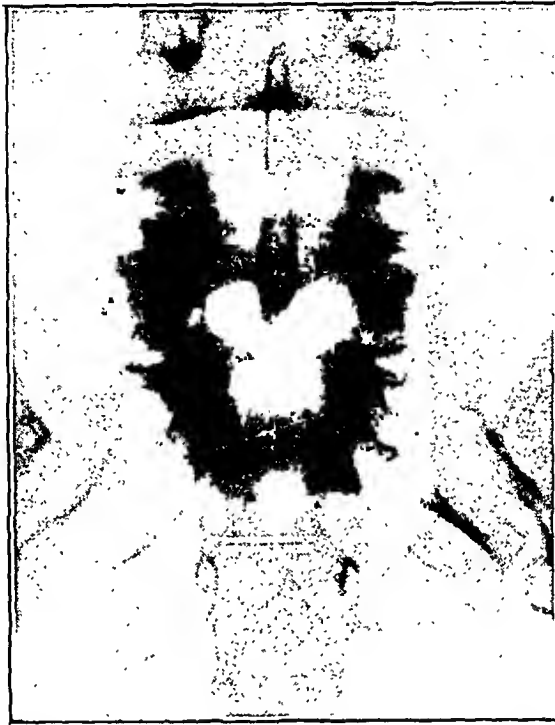


Fig. 6.—Nullipara, aged nineteen, with occult spina bifida (Case 5).

## II. PROLAPSE IN PAROUS WOMEN

Table I shows that 438 of the 800 parous women (more than 50 per cent), had normal external genitalia. Since 119 of them had had from four to eighteen deliveries, it is evident that a “healthy” woman with

TABLE I. STUDY OF 800 PAROUS WOMEN.

	NUMBER OF DE- LIVERIES	NUMBER OF WOMEN	NORMAL	SLIGHT DEGREE OF VAGINAL DESCEN- SUS, REQUIRING NO TREATMENT	PROLAPSE CAUS- ING SYMPTOMS RE- QUIRING TREAT- MENT
Group 1	1- 3	530	319 = 60.2%	138 = 26.0%	73 = 13.8%
Group 2	4- 6	190	95 = 50.0%	48 = 25.3%	47 = 24.7%
Group 3	7-18	80	24 = 30.0%	29 = 36.3%	27 = 33.7%
Total		800	438 = 54.0%	215 = 27.6%	147 = 18.4%

a sound constitution is able to stand an enormous amount of strain without damage to the genital tract. The patients with “a slight degree of vaginal descensus requiring no treatment,” are grouped in column four, although they will be considered “normal.” It should be emphasized that these women showed such a slight degree of relaxation that they cannot be designated as “inferiorly constituted,” since in many in-

stances the slight protrusion of the vaginal wall was due merely to traction of scar tissue resulting from old perineal repairs, and did not impress one as a beginning prolapse. Only 28 of these 215 women had vague subjective symptoms which may have been caused by the relaxation. The diagnosis of descensus, or prolapse, was justified only in 147, i.e., 18.4 per cent of the 800 women.

The percentage of prolapse shows a marked rise as the number of deliveries increases. This does not in any way contradict the conception that the individual constitution is of paramount importance in the etiology of prolapse. It is not the purpose of this communication to deny entirely the influence of "birth injury," but rather to emphasize the significance of constitutional factors which have been almost overlooked.

It is of interest to note, in support of this conception of the etiology of prolapse, *that stigmas of asthenic constitution could be found in more than half of all the women listed in column five.*

This applies especially to 22 women, in each of whom the prolapse became manifest immediately after the puerperium, although they had had, except for a single case of forceps application, uncomplicated spontaneous deliveries. Most of the women were twenty to twenty-eight years old, with only three "old primiparas," thirty-one, thirty-six, and thirty-six years of age, respectively. Considering the relation between the appearance of the prolapse and the age of the women, there is a rapid increase in the incidence of prolapse up to the twenty-ninth year. These women have a definite, constitutional, functional inferiority, and there are certainly some among them who would have developed prolapse even without the damage incident to parturition.

The greatest number of prolapses appeared, as was expected, between the forty-fifth and fifty-fifth years. In these women, the pelvic tissues had sufficient elasticity and tonus to prevent the early development of prolapse after childbirth, and the moderate degree of constitutional inferiority became manifest only during the years of physiologic decrease of functional efficiency.

After this period, there is a rapid decline in the frequency of prolapse, because the women who passed through the climacterium without damage are those whom we may call "normal," and who would therefore not be likely to develop prolapse. In the great majority of cases of postmenopausal procidentia, it will be found that the derangement was present or had started many years before, at the beginning of or during the change of life.

The investigations presented in this paper, aside from their scientific interest, are not without practical value. The entire make-up, the constitution, of the patient may occasionally have more value in regard to etiology and prognosis than a careful physical examination and laboratory tests. Consideration of constitutional variations may, espe-

cially in the pre- and postnatal patients, enable one to recognize in advance those women who are more endangered by pregnancy and parturition, and who therefore require more than the ordinary care.

### CONCLUSIONS

1. The etiology of prolapse is largely a constitutional problem.
2. Birth injury acts merely as an initiating factor in the production of prolapse.
3. In healthy, ideally constituted women, more than 50 per cent never suffer from prolapse, regardless of the number of children they have borne.
4. Prolapse develops most commonly during the climacterium, at which time the tissues of the body become relaxed and less resistant, so that a slight degree of constitutional inferiority may become manifest.
5. The early appearance of prolapse shortly after the first delivery stigmatizes the patient as being constitutionally inferior.
6. Retrodisplacement of the uterus by itself does not favor the development of prolapse, but it may be of significance as a symptom of the patient's constitutional inferiority. Therefore, it is not justifiable to operate upon patients with movable retroflexions under the pretense of prophylaxis.

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# AVITAMINOSIS AS A LIKELY ETIOLOGIC FACTOR IN POLY- NEURONITIS COMPLICATING PREGNANCY, WITH THE REPORT OF A CASE\*

RALPH LUIKART, M.D., F.A.C.S., OMAHA, NEB.

(From the Department of Obstetrics, Creighton University)

THE object of this communication is twofold: first, a plea for clinical and pathologic studies of the nervous system in hyperemesis complicating pregnancy; second, to report observations made on the nervous manifestations in a fatal case of vomiting of pregnancy, and, based on a similarity of these manifestations and pathologic sections (polyneuritis) to beriberi, Korsakow's syndrome, pellagra, etc. (Figs. 1 to 6), to suggest vitamin B complex† lack as an etiologic factor in this disease complex. These observations we hope may prove to be of some value in the constant effort which is being made to clear up this ever perplexing problem.

Berkwitz and Lufkin's<sup>1</sup> report is a very complete summary of somewhat similar cases collected from the literature, numbering over 500 and dating back to 1854. Of this group only 56 cases were typical, 4 of which were personal cases reported in detail. Regardless of the fact that the uterus was emptied in all 4 cases, three artificially and one spontaneously, the disease progressed to a fatal termination in 3 out of the 4 cases (75 per cent mortality). In their conclusions they suggest abortion as soon as neurologic symptoms appear. Plass<sup>2</sup> reported 8 personal cases in detail with an 85 per cent mortality. Seven of the 8 patients died. The uterus was emptied in 5 cases, in 4 of which the disease progressed to a fatal termination. The fifth was improving at the time of the report.

A study of these cases shows that, if the nervous element of the disease is advanced, abortion is of no avail, definitely indicating that some concomitant etiologic factor exists in addition to the pregnancy, or that some complication develops as a sequela of the disease or from some shortcoming in the treatment during the pernicious vomiting of pregnancy.

## REPORT OF CASE

E. G., married, aged thirty-one years, tall, well proportioned, weight 210 pounds, para iii. First pregnancy complicated by vomiting; spontaneous abortion at two months. Second pregnancy spontaneous delivery at seven and one-half months, living child now eight years old. Previous history and family history negative.

\*Read at the Fourth Annual Meeting of the Central Association of Obstetricians and Gynecologists, Memphis, Tenn., September 15-17, 1932.

†Vitamin B complex refers to the complex containing Vitamin B<sub>1</sub> the antineuritic vitamin, and Vitamin B<sub>2</sub>, the antipellagra vitamin.

I first saw the patient in February, 1931, with no complaint except inability to conceive. The physical examination, including complete blood count, Wassermann and urine, was negative except for a 3+ erosion of the cervix with a profuse discharge. Air insufflation was positive. Hysterosalpingogram refused. Cauterization was advised but because of nervousness she postponed it until September, 1931. She menstruated once after the cauterization. Result of cauterization excellent. January 13, 1932, she reported that she had not menstruated since November 16 and was vomiting a great deal and had several small ulcers in her mouth. She had lost 20 pounds. The blood pressure was 130/75, temperature 98.6°, pulse 90. The urine was negative.

The ulcers were touched with silver nitrate, 10 per cent. General prenatal advice was given with suggestions in regard to the nausea, and elixir luminal—drams 1 q. i. d., fifteen minutes a. e. was ordered.

The nausea persisted, gradually growing more severe. There were complete remissions of twenty-four to forty-eight hours during which time large quantities of water were taken. Each time it seemed she had turned the corner and the period during which nausea might be expected was past. There would be some temporary improvement followed immediately by a severe increase of nausea, and marked restlessness and irritability. After one of these remissions during which there was an intake of some food and 3600 c.c. of liquids a day for two days she became hysterical and complained of extreme weakness. She retched until she brought up blood. Her condition became so severe it was necessary to hospitalize her (March 16). She was well past her third month of pregnancy. She had lost 50 pounds in weight.

Treatment consisted of isolation, nothing by mouth, hypodermoclysis and intravenous saline and glucose to protect and build up the glycogen reserve of the liver as originally suggested by Titus.<sup>3</sup> In addition she was given luminal sodium hypodermically, grains 1½ q. i. d. as originally suggested by me.<sup>4</sup>

During the first five days of hospitalization her intake of saline and 10 per cent glucose by mouth, rectum and parenteral administration totaled 20,000 c.c. (*vitamin free nutrition*). The relief was only temporary and her pulse gradually rose to 100.

A duodenal tube was passed and over a period of three days more than 3,000 c.c. of orange juice, broth, lactic acid milk and cream and glucose were retained (*note the vitamin-containing food and the result*). The tube was removed and the patient retained goodly amounts of food given by mouth. A decided anorexia persisted. The vomiting of pregnancy was relieved as a result of treatment, but *the vitamin deficiency in this therapy as commonly employed must be acknowledged*.

March 31 the patient had passed the seventeenth week of pregnancy. She left the hospital eating fairly well, with no emesis, weak but able to walk about. The nervousness had almost subsided.

*Laboratory:* Daily urine examinations were negative after the fourth day in the hospital. R.B.C. 4,170,000, Hb. 90 per cent, W.B.C. 10,800, polymorphonuclears 70, lymphocytes 30. B.M.R. +20 (a normal rise during pregnancy). The metabolic test was done because of the persistent tachycardia, extreme irritability and dry, scaly skin. The Wassermann was negative.

The neurologic examination was practically negative except for weakness and hypersensitivity. All reflexes were hyperactive. There was some tenderness in the leg muscles, especially of the calves. No pain. Leg extension and leg raising was good. There was a constantly increasing flaccidity of the muscles. The calves hung down like bags of water. Her speech was whiney and thick.

Three days after going home the anorexia returned. There was little or no nausea but the weakness increased and nine days after leaving the hospital she



Fig. 1.—Anterior horn cell. Case of pellagra.\*

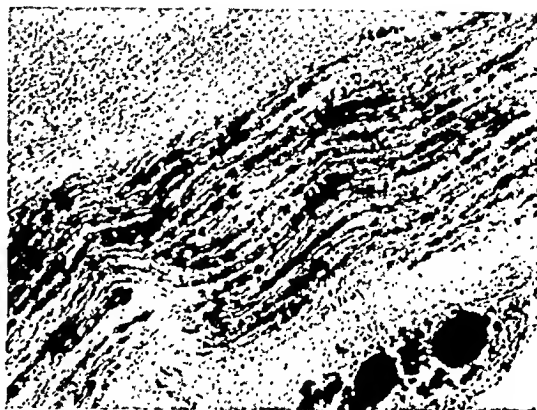


Fig. 2.—Marchi degeneration in lumbosacral nerve. Case of pellagra.

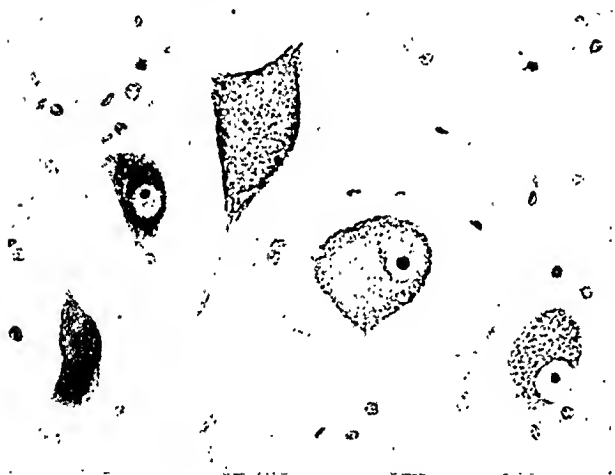


Fig. 3.—Anterior horn cell. (Berkwitz and Lufkin case.)



Fig. 5.—Anterior horn cell. Author's case.



Fig. 4.—Marchi degeneration in lumbosacral nerve. (Berkwitz and Lufkin case.)

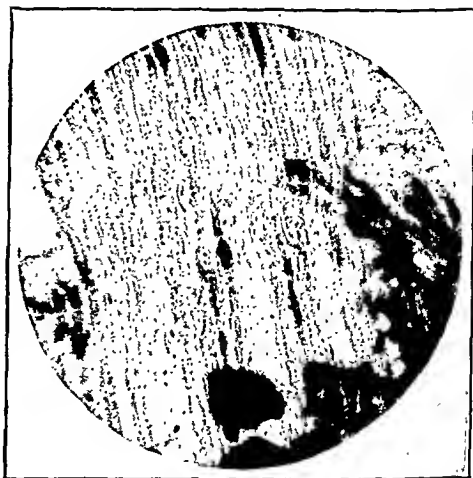


Fig. 6.—Marchi degeneration in lumbosacral nerve. Author's case.

became mentally confused, her vision became blurred, her speech less clear, tachycardia more pronounced and numbness of the feet developed, the latter thought to be due to the luminal sodium. Nystagmus, both perpendicular and transverse, developed. She held her eyelids half closed, giving a squint-like appearance, like a devitaminized animal. She could not tell the time of day or day of week. Her tongue was thick, red and dry and of a granular appearance. The reflexes of the upper extremities were normal, hand clasp of fair strength. The knee jerks were absent. She cried out when her legs were touched or an attempt was made to raise them to test for knee jerks. There was no clonus, no Babinsky, and no Oppenheim reflexes. Control of the rectal and bladder sphincters was lost. The symptoms increased until there developed a condition typical of Korsakow's syndrome.

A diagnosis of polyneuritis was made and confirmed by Dr. George Neuhaus who advised administration of vitamin B (antineuritic).<sup>5</sup> Brewer's yeast was given in doses of drams 2 q. i. d. (Rice polishings\* as prepared by Seidelt's method<sup>6</sup> could not be procured.) At the end of thirty-six hours the tenderness was almost gone from her legs, but she could not raise her legs from the bed. The hyperesthesia had subsided. Her eyes appeared quite normal. She said she felt better, but the heart rate had reached 130. It was impossible to get her to swallow sufficient liquids. Her tongue was so swollen that it filled her mouth. She was dehydrated and it was deemed necessary to get her back into the hospital. She became unable to retain the yeast.

She entered the University Hospital April 16. Examination of the eye grounds by Dr. Stokes showed in the right eye: definite blurring of disc margin but no elevations. No hemorrhage or exudate. Vessels normal. Left eye: narrow flame hemorrhage between superior temporal artery and vein; 1 disc diameter long and twice the width of the vein, 1 disc diameter out from the nerve. No definite blurring of disc or other changes.

April 17. Blood count: Hb. 72 per cent, R.B.C. 3,960,000, W.B.C. 8,600, polymorphonuclears 83, lymphocytes 12, mononuclears 5. Urine negative. Blood Wassermann negative.

*Blood chemistry:* Nonprotein nitrogen 30.1 mg. per cent. Chloride 497 mg. per cent.

*Lumbar puncture:* pressure 6 mm. Hg. spinal fluid Wassermann negative. Protein 10 mg. per cent. Cell count 2, uric acid 3.7 mg. per cent, serum nonprotein nitrogen 23.4 mg. per cent, total serum protein 5.9 per cent, total serum albumin 4.7 per cent, cholesterol 176 mg. per cent.

*Blood pressure:* Systolic 135, diastolic 70. Temperature 99°, 100° at 2, and at 4 A.M. 103°. Pulse 160. Lower extremities flaccid.

The patient's condition rapidly grew worse in spite of administration of quantities of glucose and saline by vein and under the skin. She died April 18.

*Autopsy:* All gross findings were negative. Sections of the liver, kidney and spleen showed cloudy swelling. Gross examination of nerves was negative. Microscopically the sections revealed definite degeneration of the anterior horn cell with

\*Extract of Rice polishings prepared by Block and Cowgill has been injected subcutaneously and intravenously with success, although injection is painful because of a vasodilator substance; personal communication Dr. Cowgill to Dr. Victor Levine, May 28, 1932. (Rice polishings extract is available.)

\*Comparison of Marchi degeneration (right column) and neurone changes in anterior horn cells (left column) in pellagra (Figs. 1 and 2);<sup>12</sup> in neuronitis of pregnancy (Cases of Berkwitz and Lufkin,<sup>13</sup> Figs. 3 and 4); and in the author's case (Figs. 5 and 6). All three cases show definite Marchi degeneration in the sections illustrated which are taken from the lumbosacral nerves. The neurones in each case show swelling, eccentric nuclei and loss of Nissl substance. In the author's case there is an occasional polymorphonuclear and plasma cell, and definitely more degeneration of the neurones as shown by their more rounded contour.



occasional polymorphonuclear leucocytes and plasma cells. The lumbosacral nerves showed definite Marchi degeneration.

It was definitely observed throughout the illness of the patient that when her system was flooded with large quantities of water and glucose, which of course are vitamin free, she showed a temporary improvement followed immediately by an exaggeration of symptoms unless vitamin containing nutrition was administered with the water and glucose. This observation is in close keeping with Cowgill's<sup>7</sup> work in which he has pointed out that the expression "toxemia" is drawn into service at present as an explanation for a variety of manifestations of disease for which no clearer interpretation is available. Startling cures that occur following the administration of vitamins to so-called polyneuritic pigeons, in which nerve degeneration can be demonstrated so readily, can hardly be explained as due to sudden correction of the degenerative changes in nerves. This has led many of the investigators to favor the idea of toxemia from toxins injected with food or from faulty metabolism. One of the methods supposed to relieve such a condition consists in "washing out" the system by liberal intake of water and producing a vigorous diuresis. This process is sometimes accelerated by the parenteral administration of fluids. The plan has been put to the test in the laboratories at Yale in the Physiological Chemistry Department by Cowgill and his collaborators in the case of animals deprived of their optimal intake of vitamin B complex by a selected régime. When they were given large amounts of water it was found, contrary to what might be anticipated, that the time required for the appearance of the anorexia characteristic of this dietary essential was markedly shortened. Instead of being protected, the animal was rendered more susceptible to the deficiency of the vitamins. Cowgill points out that this result is not in harmony with the hypothesis that the symptoms of deficiency of Vitamin B complex are essentially those of toxemia. The urge to eat was restored by undifferentiated vitamin B complex. His explanation of the results of the forced fluids is a temporary relief of the anorexia and anhydremia, but the removal of the vitamins by the diuresis may actually be detrimental in that it washes the vitamin B complex from an already partially depleted body. Certainly sufficient evidence is at hand, he concludes, that trials of the administration of some potent source of vitamin B complex are warranted. In any event the vague assumption of an existing toxemia may no longer be entirely sufficient to the clinician.

Cowgill<sup>8, 9</sup> also points out the well-known fact that the capacity for storage of vitamin B complex in the body is rather limited. Increased exercise definitely decreased the period required for the development

of anorexia characteristic of lack of vitamin B complex. These observations are considered to be supported by the fact that vigorous exercise increases voluntary food intake. Furthermore, the vitamin B complex intake requirement of an animal is significantly increased when the metabolic rate is increased by thyroid administration.

There is a normal increase of 20 per cent or more of the metabolic rate during pregnancy.<sup>10, 11</sup> This fact, in view of Cowgill's observations, would make logical the assumption that the vitamin B complex is endangered even during normal pregnancy.

#### SUMMARY

1. Modern scientific therapy of cases of pernicious vomiting results in avitaminosis.

2. The usual 20 per cent or more elevation of the basal metabolic rate during pregnancy may disturb the vitamin B complex balance.

3. The majority of the advanced cases of polyneuritis with pregnancy reported have shown no cessation of the disease by abortion.

4. There is close relationship between the clinical symptoms and pathologic findings to Korsakow's syndrome. Here the neuritis is supposed to be due to the constant vomiting of alcoholism, and ultimately to avitaminosis.

5. Pathologic sections of the neurones in beriberi, pellagra, and scurvy are similar to the sections in the cases of polyneuritis of vomiting of pregnancy reported by Berkwitz and Lufkin, and in the author's case.

6. The case reported responded to "washing out" with vitaminless glucose and saline as observed by Cowgill. There was a definite remission of many of her symptoms after forced feeding of vitamin B complex for twelve hours.

7. Neurologic examinations in hyperemesis gravidarum should be frequent and an attempt should be made to keep up the vitamin balance.

I wish to acknowledge the kindness of Dr. Victor E. Levine, Creighton Medical College, in securing the cuts of the pellagra case.

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# A CONSIDERATION OF THE SCHNEIDER MODIFICATION OF THE ASCHHEIM-ZONDEK TEST AS RELATED TO PRIVATE PRACTICE\*

HAROLD S. MORGAN, M.D., LINCOLN, NEB.

*(From the Department of Obstetrics and the Experimental Laboratory of the  
Lincoln General Hospital)*

IT IS not so much the purpose of this paper to report a series of cases, but rather to detail certain considerations of the Aschheim-Zondek test, that make for its practical application in private practice.

The Board of Trustees of the Lincoln General Hospital have recently caused to be built, and the Staff has equipped, an animal experimental laboratory, which serves as a workshop for any Staff member with a problem that requires the use of test animals. This laboratory serves the members of the Obstetrical Department as a place to conduct the pregnancy tests, as well as providing adequate quarters in which to care for the animals used.

Bearing in mind that this work was to be done, not by technicians or medical students, but by the obstetricians themselves as a part of their private practice, a method had to be developed that would entail: first, an adequate supply of test animals, second, a minimum loss of time and third, sufficiently simple to avoid the necessity of help in injecting and examining the rabbits.

In choosing between the various modifications of the Aschheim-Zondek test our preliminary experiences in procuring adult rabbits and isolating them for given periods of time was unsatisfactory. Rabbits that had been certified to us as having been isolated for three weeks were found on section to be pregnant. The repeated injections and the length of time necessary after injection before the test could be read, together with the oftentimes confusing picture of an adult rabbit ovary were disadvantages that led us to adopt the Schneider technic. As Dr. Schneider pointed out in his paper before this society last year, the finding of one hemorrhagic follicle in each ovary is sufficient to make a positive diagnosis. Failure in demonstrating the hemorrhagic follicles leads at once to a negative diagnosis. We feel that the clear-cut reaction obtained when juvenile rabbits are used is a decided advantage of this modification.

The next problem we faced was that of securing a supply of rabbits. We were able by offering slightly more than the market price of meat rabbits, to obtain a rabbit breeder who would segregate the males from the females in each litter after weaning and at the fourteenth week, house the females in separate cages. If at the end of eighteen weeks the does have not been used, they are used by the breeder for any purpose. The market price for meat rabbits in this community is seventy-five cents and for twenty-five cents more, we are assured of a constant supply of dated, virgin does. In order to facilitate the ordering and paying for the rabbits, my office has been made the clearing house and whenever

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a rabbit is needed, my secretary is notified and orders the rabbit, usually in the afternoon in order that the breeder need not make several trips to the hospital. At the end of the month each member of the department having ordered rabbits receives a statement from the secretary and the breeder is paid in a lump sum. This system has now been in operation seven months and has proved at once practical and economical both in time and money.

As mentioned before, the tests are conducted by the individuals of the department and usually in the late afternoon or evening at a time when assistance is difficult to obtain. After our entirely unsatisfactory experiences in injecting the rabbits without help, Dr. H. E. Harvey devised the box illustrated in Figs. 1 and

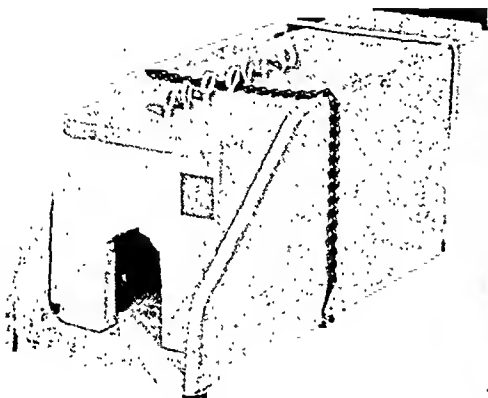


Fig. 1.



Fig. 2.



Fig. 3.

2. A single trial of the box served to convince us of its absolute value and now we would hesitate to inject a rabbit without its aid. Fig. 2 demonstrates the box in operation. The top piece being movable, any size rabbit may be held firmly and cannot jump at the wrong moment. It is our practice to place the animal in the box and after rubbing the ear briskly with a pledget soaked with xylol, an electric light is placed in front of and below the box. The xylol acts as a local dilator, rapidly causing a dilatation of the ordinarily small marginal ear vein to four or five times its normal size. The light transilluminates the ear, causing the dilated vessels to stand out sharply and one can determine at once that the needle remains in the vein. This feature, though not necessary in well-lighted quarters is quite worth while in artificial light.

Frequently it becomes advisable to section the test animal, rather than sacrifice it, particularly since it has been shown that even following a positive reaction, the rabbit may be used again three to four weeks later for pregnancy tests or for other purposes. To do this a suitable anesthetic must be used, and to fit our particular requirement, the anesthetic must of necessity be sufficiently simple to permit of administration by the operator. To this end, inhalation anesthetics were discarded and sodium amytal was adopted. Here our experience, unlike that of others has been entirely satisfactory. It is our practice to dissolve the contents of one capsule of sodium amytal (3 gr.) in 6 c.c. of sterile water. Solution is accomplished by bringing the mixture just to a boil in the test tube. The amytal goes into an opalescent suspension at the boiling point. When cooled down to body heat it is injected slowly intravenously. We find that the average fifteen- to eighteen-week rabbit will require  $2\frac{1}{2}$  gr. of sodium amytal. Care is exercised to see that the injection is carried out slowly, inasmuch as the only mortalities that we have had, have occurred after rapid injection. The syringe and needle used to inject the amytal need not be sterile. As soon as the injection is completed the rabbit is placed in the operating trough (Fig. 3) and strapped in position. This trough is simply a modification of the operating boards in use in dog surgery courses in our medical schools. The belly is then prepared, first clipping the fur from the midline and applying a depilatory compound, made up of barium, gray, 2 ounces; zinc oxide, 2 ounces; and starch, 3 ounces. A portion of this is mixed into a thick paste with water and applied to the desired area. When dry it is rubbed off, bringing the fur with it. By the time the belly is prepared and painted with mercurochrome the animal is sufficiently anesthetized for surgery.

In my early experience with the pregnancy test, strict aseptic technic was carried out in closing the laparotomy. Sterile drapes, gowns, gloves, and instruments were used. However, the costliness of this procedure, both in sterile supplies and time consumed, led me to deliberately violate all custom and discard all sterile supplies, save the few easily boiled instruments. Sutures have been purposely dragged over the fur of the animal and to date no infections have developed. Our technic now consists of elevating the rabbit in Trendelenburg position, opening the abdomen in the midline, pushing back the intestines with a piece of sterile gauze, and inspecting the ovaries gently. The belly muscles and peritoneum are approximated with a continuous black silk suture, the same suture being used to close the skin, thus making a two-layer closing. The animal is then placed in a warm clean cage and allowed to recover.

In presenting the series of tests conducted, no attempt is made at this time to detail the individual cases, the detailed analysis being reserved for a later communication. The report covers the tests performed by Drs. Hansen, Harvey, Munger, Whitham and myself and I desire to express my appreciation to them for their kindness in permitting me to use their records.

Out of our series of nearly 100 cases in which the test has been performed, we have 87 in which the results have been proved clinically. No test has been utilized for this report in which the actual condition has not been verified either by operation or the subsequent history of the patient. Of the 87 tests, 2 were proved wrong, both of the errors occurring in the group reported as negative. None of the group reported as positive were found to be wrong. The percentage of error,

then in our group of 87 cases will be 2.2 per cent, thus corresponding favorably with country-wide estimates of the reliability of the test.

In conclusion, it is of interest to note the demand on the part of both patients and doctors for this test, since its introduction. Those of us doing the test have almost a constant demand from surgeons and internists to help them rule out tumors, ectopic gestations, and hydatid moles, and with the facilities at our disposal we are able to meet these requests promptly.

In our hands the Schneider technic is entirely satisfactory and the plan outlined in this communication is peculiarly fitted to the requirements of private practice, where the facilities of the teaching hospital with its laboratories and extra help are not available.

723 SHARP BUILDING.

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### TRICHOMONAS VAGINALIS (DONNÉ)\*

IRVING F. STEIN, B.S., M.D., AND ELIZABETH J. COPE, B.S., CHICAGO, ILL.

GREAT interest has become manifest in the subject of *Trichomonas vaginalis* vaginitis in the past few years as evidenced by the numerous publications on this subject in almost every language in the current medical literature. In review, there is almost complete unanimity of opinion as regards the clinical picture of this disorder and in consequence its ready recognition has become common. The source of the trichomonad and its pathogenicity, however, has become the subject for investigation, there being still a wide divergence of opinion.

The present report encompasses a study of 61 additional cases since our previous publications.<sup>1, 2</sup> In this we aimed to discover the source of vaginal infection with trichomonads through an investigation of the various sites of trichomonad incidence in the body. In order to secure sufficient material for this work, the routine urine specimens from the prenatal patients in the Mandel Clinic of the Michael Reese Hospital were examined for the presence of trichomonads. During nine months we examined a total of 2462 voided urine specimens from 889 patients. Trichomonads were found in the urine of 88 patients, an incidence of 10 per cent. Forty-one patients from this clinic group, 3 private prenatal patients, and 17 gynecologic patients (7 private and 10 clinic) were examined for the presence of trichomonads in the four commonly recognized sites of infestation: the vagina, the gums, the intestinal tract, and the bladder. Warm stools after saline catharsis (magnesium citrate) were examined by the hanging drop method, and cultures were made to

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From the Obstetrical and Gynecological Department of the Michael Reese Hospital and the Nelson Morris Institute for Medical Research, supported by a grant from the Albert Kuppenheimer Fund.

ascertain the presence of trichomonads and yeasts. Catheterized specimens of urine were obtained and were immediately centrifugalized; the presence of trichomonads and yeasts in the sediments was determined by hanging drop examination and by cultures. The gums of each patient were rather vigorously rubbed with a sterile cotton applicator which was then placed in 3 c.c. of placenta broth for transportation to the laboratory. From this suspension hanging drop examinations and cultures were made. Vaginal secretion was obtained and examined by the method described in our previous papers. (Gram stains were made for detection of gonococci and other bacteria.)

Fresh hanging drops were used in examining material from the four sites for living trichomonads. Three subplants were made; one on Sabouraud's medium for the cultivation of yeasts, a second in Loëke's solution with 5 per cent human blood serum covering placenta agar slants and a third in the same solution covering blood agar slants for the growth of the trichomonads.

In this group of 61 patients trichomonads were seen on direct examination and were grown in artificial culture mediums from the vaginal secretions in 58 patients, from the catheterized urine in 5, from warm stools in 3, and from the gums in 4 patients. One patient revealed trichomonads in the vagina, bladder, and gums. The 3 patients not yielding the vaginal parasite were from the clinic prenatal group. One of these had trichomonads in one of the three voided urines examined before delivery, but direct smears and cultures from the catheterized specimen of urine, vaginal secretion, and stools were negative after delivery. Curiously enough, however, at the same time cultures from the gums were positive for trichomonads. One prenatal patient showed living trichomonads in one of three voided urine specimens examined before delivery, but none could be found in any of the four sites examined ten days and six weeks after delivery. The same experience was encountered in a second case with the exception that the living trichomonads were found in all of five voided specimens examined before delivery. The possibility of these individuals acting as temporary carriers of the protozoa must be considered because none of them complained of any of the symptoms commonly associated with vaginal infection with *Trichomonas vaginalis* even when questioned carefully.

From these results it is obvious that whereas there are cases where trichomonads are found in more than one location in the same individual, it is not usual. They are probably independent rather than cross infections, with the possible exception of the dual incidence in the vagina and bladder.

Among the 58 patients we found yeasts in addition to the trichomonads in the vaginal secretion of 10; 7 of these were prenatal and 3 were gynecologic. Yeasts were obtained on culture from the gums of 15 patients, one of whom also had *Trichomonas buccalis*. From the stools,

yeasts were found in 27, one of which also contained *Trichomonas hominis*; in the 5 cases where yeasts were found in the catheterized urine specimens, no trichomonads were found. These figures indicate a coincidental incidence rather than a habitual association of trichomonads and yeasts.

An effort was made to examine a number of husbands for a possible conjugal source of infection, but only 3 men appeared for investigation. In 2 of the husbands no flagellates were found when voided urine specimens and prostatic secretions were examined by fresh hanging drop and culture methods, although one of the men had been under a urologist's care for a nonspecific urethritis. The third, a colored man, yielded trichomonads in the prostatic secretion and in the voided urine, and his wife was found to have a typical *Trichomonas vaginalis* vaginitis. We were unable to determine which partner was first affected. This is the only conjugal example we have observed.

Nothing has been proved concerning the infectiousness of *Trichomonas vaginalis* vaginitis. It is interesting to note in this connection that among 4 little girls with *Trichomonas* vaginitis, observed by Frankenthal and Kobak<sup>3</sup> in our vaginitis clinic, two were sisters. The mother of the children was examined and found to have a similar infection, and investigation of the home revealed very poor hygienic conditions. Three of the 4 children in this report had not yet menstruated, and the fourth had one period six months previously.

The possibility of foods and their handling as a factor in the transmission of the parasite, and incidentally the question of the effect of vitamins on the growth of the parasite, prompted us to make a series of cultures using bean sprouts and lettuce as mediums. Canned bean sprouts in their own liquid were used for one group, and a suspension of shredded lettuce in physiologic salt solution was used for the other. These and other mediums used routinely as control cultures received simultaneous inoculations from actively growing cultures of *Trichomonas vaginalis*. No growth or survival of the trichomonads was found in any of the tubes containing the lettuce suspension when examined at the end of twenty-four and forty-eight hours' incubation at 37° C. At the end of twenty-four hours' incubation a few motile trichomonads were present in all tubes containing bean sprouts, but none were found at the end of forty-eight hours' incubation, indicating a survival rather than active growth of the protozoa. This result suggests the possibility of transmission of *Trichomonas vaginalis* by means of material carriers when moisture and temperature conditions are favorable.

#### FURTHER OBSERVATIONS OF CULTURAL CHARACTERISTICS

In isolating the trichomonads from various sources, certain cultural variations were noted. Continued studies in the morphology of *Trichomonas vaginalis* were made, using fixed smears stained with iron-



hematoxylin, hanging drops of living flagellates stained with vital stain, and the dark field microscope. Motion pictures of the microscopic dark field were also obtained.

Two of the most commonly observed characteristics of the discharge of *Trichomonas vaginalis* vaginitis are the foul odor and the bubbly consistency of the discharge. A similar odor is found in artificial cultures of *Trichomonas vaginalis* accompanied by the presence of large amounts of gas. This gas production frequently forces the slants toward the top of the test tubes, even when very large tubes are used. Frequently a bubbly froth is present on the top of the cultures. The parasite grows well when either blood agar or placenta agar slants are used as a base, but apparently more luxuriantly with the latter. The trichomonads which we isolated from the stools in our cases grew very poorly when placenta agar slants were used, but with blood agar slants were readily cultivated with the formation of a small amount of gas. These cultures produced a characteristic odor which differed noticeably from that of the cultures of the vaginal parasite. The *Trichomonas buccalis* grew readily with the formation of a moderate amount of gas when placenta agar slants were used, but scantily, if at all, when the blood agar slants were tried. The odor of these cultures differed from the two mentioned above and resembled very closely that of foul breath. The trichomonads isolated from the bladder were apparently in all respects similar to those isolated from the vagina. Before attempting, however, to draw any conclusions as to the significance of the cultural characteristics described it is, of course, necessary to take into consideration the fact that these were not pure cultures of trichomonads. The associated bacteria in the material from which the cultures were made (i.e., the vaginal secretion) also grew in these cultures, and their presence must be evaluated as contributing factors to these cultural characteristics.

It is quite obvious, however, from our observations, that the trichomonads found in the voided urine in women are almost invariably derived from the vagina. Possibly some of those found in stools (Hees<sup>4</sup> found them in 47 patients) may also be contaminations from the vagina, as the vaginal discharge in *Trichomonas vaginalis* vaginitis is often very profuse and liquid. Straining at stool can be conceived to force droplets of vaginal discharge into the specimen. On the other hand, the infection of the vagina by trichomonads has not been proved to be the result of transplantation of the parasite from other foci of incidence in the individual. When the taxinomic differences reported by Bland et al.<sup>5, 6</sup> and the cultural differences reported by us are considered, in addition to the rarity of multiple incidence of trichomonads in various typical locations in the body, it appears necessary to consider the trichomonad associated with *Trichomonas vaginalis* vaginitis as a specific

protozoan localizing in the genitourinary tract, the source of which must be sought elsewhere.

In an effort to explain the aggravation of symptoms in *Trichomonas vaginalis* vaginitis following the menstrual period, a series of comparative cultures were studied. Simultaneously, subplants were made in which placenta agar slants were used as a base; Locke's solution with 5 per cent fresh human blood serum was added to one group, Locke's solution with 5 per cent fresh human blood serum and 4 per cent progynon\* (female sex hormone) was added to the second, and Locke's solution plus 4 per cent progynon to the third. Tubes from each of the three groups were inoculated with equal amounts of the same actively growing culture of *Trichomonas vaginalis*. At the end of twenty-four and forty-eight hours' incubation at 37° C. comparisons were made by calculating the number of trichomonads per average high power field. It was observed that the addition of the progynon without the blood serum greatly stimulated the growth of the parasite; the addition of the progynon with the serum also stimulated it, but to a lesser degree. The third group in which Locke's solution plus serum was used served as a control group. It would seem from this experiment that the sex hormone content of menstrual blood may be a more important factor in causing the postmenstrual flare of *Trichomonas vaginalis* vaginitis than the presence of blood serum and possibly also of tissue fragments.

#### STAINED PREPARATIONS

Very little has been reported regarding the life cycle and the habits of *Trichomonas vaginalis* although the consensus of opinion is that reproduction occurs by binary fission (Lynch).<sup>7</sup> To facilitate this study we used two stains. For fixed slides, Schaudinn's solution was used as a fixative, followed by an iron hematoxylin stain. This was useful in studying the structure of the flagellate (Fig. 1). Variations in the size and shape of the nucleus of the parasite as well as indications of nuclear division were demonstrated. In some instances the relative shape and position of two flagellates indicated recent division, and what appeared to be budding forms were seen, but we are not able to draw any conclusions as to the life cycle of the parasite at the present writing (Fig. 2).

For observing the activity of the living trichomonads, a 1-1000 aqueous solution of a neutral red was utilized. The addition of a small drop of this solution to a hanging drop taken from a culture of living trichomonads stained the granules in the body of the parasite and emphasized the cytoplasm, flagella and undulating membrane. The activity of the anterior flagella in whipping in food particles, bacteria, etc., apparently toward the undulating membrane and posterior flagellum was observed. They also appeared to make way through the debris while

\*Progynon was supplied by the Schering Corporation.

the parasite accommodated itself to the available space by changing shape. The ameboid activity of the parasite was demonstrated and the facility with which it changed shape and sent out pseudopodia was surprising. The trichomonads became attached to bits of débris by

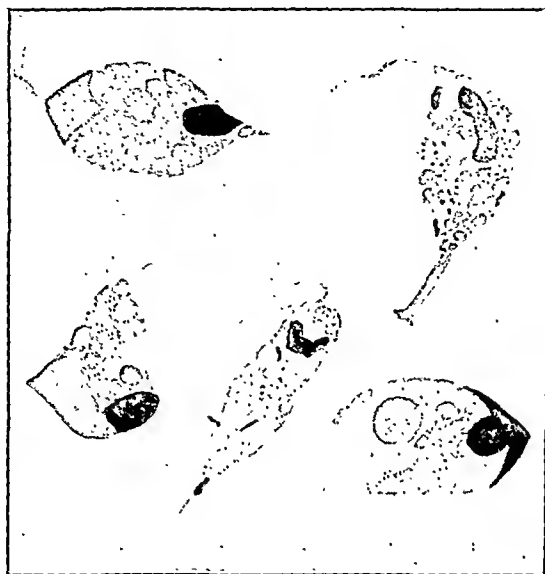


Fig. 1.—*Trichomonas vaginalis* from twelve-hour culture. Marked variation in size and shape; apparent nuclear division. Iron hematoxylin stain.

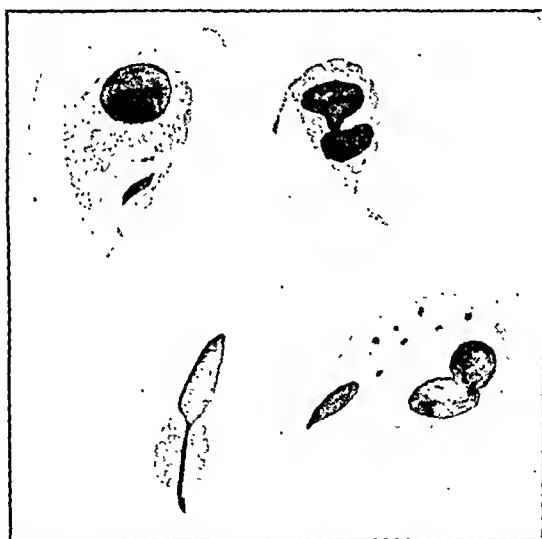


Fig. 2.—*Trichomonas vaginalis* from forty-eight-hour culture. Nuclear division, small forms, and apparent budding suggest reproduction. Iron hematoxylin stain.

the axostyle and from this anchorage they rotated and changed shape rapidly. Frequently the granules appeared to gather in the posterior end, while the anterior end of the flagellate became elongated. There was often a very decided narrowing in the center, sometimes becoming hairlike, but in no instance was actual division seen. A resumption of

the normal pear shape from this dumb-bell shape was observed in some instances. When motility ceased, the trichomonads became round and the flagella seemed to fold around its circumference. Apparently this indicated the death of the parasite.

#### RESULTS

Among 58 women with *Trichomonas vaginalis* vaginitis, trichomonads were found in the gums in 3, in the stools in 3, and in the catheterized urine in 5. It is apparent from this observation that there is no causal relationship between the vaginal incidence and that of other common sites of trichomonads in the body. There are cultural characteristics which differentiate the vaginal trichomonas from the buccal and intestinal types. While occasional instances of infection of husband and wife, and one case of infection of three female members of the same family are reported, the evidence is insufficient to conclude that it is directly transmitted from person to person.

The addition of female sex hormone to culture medium stimulated the multiplication of *Trichomonas vaginalis* in vitro.

The source of trichomonads in the vagina is unknown. It is unlikely that they may migrate from the other common sites in the body.

We still support the belief that *Trichomonas vaginalis* is pathogenic in the human being; that it is a specific species of trichomonas; that it is apparently in symbiosis with the bacteria commonly found in the vagina.

We wish to acknowledge our indebtedness to our colleagues in the Hospital, the Clinic, and the Institute for materials and assistance, and to Drs. Frank Wright and Albert Zrunek for apparatus and assistance in obtaining motion pictures of the microscopic dark field.

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310 SOUTH MICHIGAN AVENUE.

## ENDOMETRIAL HYPERPLASIA\*

### A REVIEW OF EXPERIMENTAL WORK

LUCIUS E. BURCH, M.D., AND JOHN C. BURCH, M.D., NASHVILLE, TENN.

(From the Department of Obstetrics and Gynecology, Vanderbilt University School of Medicine)

AN INTENSIVE study of endometrial hyperplasia has been in progress for the past three years in the laboratory and clinic of this institution. This paper is a brief summary of some of the results which have been obtained. Some of the results have been reported,<sup>6, 7, 9, 20, 21</sup> and others will be reported in the near future.

The exact etiology of endometrial hyperplasia has not been determined, but our results have shed some light on the question and have pointed the way to further research which is now in progress. Before discussing these findings, it seems desirable to review briefly the outstanding facts which serve to correlate the menstrual cycle of the human being with the estral cycle of experimental animals.

Allen<sup>1</sup> has accurately described this cycle for the mouse. The unmated mouse has a period of estrus every four to six days. At the time of estrus a characteristic change takes place in the vagina. This change consists in cornification of the vaginal mucosa, which is easily determined by means of smears. Ovulation takes place during the latter part of the estral phase, but the corpus luteum of the mouse remains inactive unless the animal copulates. When the female is mated with a vasectomized male, a stage of pseudopregnancy follows. This state of pseudopregnancy corresponds to that part of the human menstrual cycle lying between the time of ovulation and the onset of menstruation. Its main characteristic is a growth of the uterine mucosa, which, in the essential details, is similar to the human premenstrual endometrium. The time before the next estral period in the mouse is prolonged by pseudopregnancy from the normal four- to six-day interval to an eight- to fourteen-day interval. If copulation does not take place the corpus luteum is not activated and the uterus of the animal regresses from its estrus enlargement and reaches a resting stage. Two to three days before estrus the epithelium becomes very active, the epithelial cells of the glands multiply, and numerous mitotic figures appear. There is definite pseudostratification of the epithelium and edema of the stroma. Occasionally mitoses are noted in the stroma cells. When the pseudopregnant condition occurs, the gland cells lose their pseudostratified arrangement and become more regular. No mitoses are present at this stage. Therefore, in the mouse, we have two distinct phases, one before ovulation and one after ovulation. In the human female, following menstruation, the endometrium is of a low columnar type, no mitoses are present, and there is no secretion in the glands. In a few days a period of growth begins, the gland cells multiply, mitoses can be found and the mucosa increases in thickness. Following ovulation, a corpus luteum forms. In the human being this structure functions irrespective of the act of

\*Read at the Fourth Annual Meeting of the Central Association of Obstetricians and Gynecologists, Memphis, Tenn., September 15-17, 1932.

copulation. Following the formation of the corpus luteum, the endometrium increases in thickness, but its appearance and histologic characteristics are markedly changed. Numerous tufts or papillae project into the lumen of the gland. The glands gradually become more dilated, the nuclei assuming a more central position; there are no mitoses and no pseudostratification. The glands contain secretion. From this very brief description, it can readily be seen that the histologic changes occurring in the mouse are quite similar to those that are found in the human being.

The estrus hormone, isolated by Allen and Doisy,<sup>3</sup> and Frank,<sup>15</sup> and later purified by Veler, Thayer and Doisy,<sup>29</sup> when injected into spayed mice, causes the typical picture of estrus in the vagina and uterus. Allen and Corner<sup>4</sup> have isolated another hormone from the corpus luteum, which when injected into the rabbit, produces changes similar to those found in pseudopregnancy. They have been able to maintain pregnancy after the removal of the ovaries by means of this extract.

Frank<sup>15</sup> and Smith<sup>28</sup> have shown that the estrus-producing hormone can be found in detectable amounts in the blood of human beings from about the fourteenth day until the time of menstruation. Parallel with this appearance of estrin, the corpus luteum becomes active and gives off its hormone. It is therefore fairly clear that the changes preceding ovulation are the result of the estrus hormone, and that the changes following ovulation are the result of the combined action of these two hormones.

We have approached the problem of interpreting uterine scrapings from the standpoint of attempting to correlate morphologic changes with hormonal activity. Fluhman<sup>14</sup> has likewise viewed the problem from this angle. Hyperplasias of the endometrium have long been known to be the result of a disordered ovarian activity but it has not been possible to determine the exact type of this disorder from the examination of curettings.

Schröder,<sup>26</sup> Shaw,<sup>27</sup> Graves<sup>18</sup> and others have made important contributions to this subject and have found that there are no corpora lutea in the ovaries of patients suffering from cystic glandular hyperplasia, and that the ovaries of these women are generally cystic. It is apparent, of course, from this work that a disproportion between the two hormones, resulting in an excess of estrin, is a factor in the production of the pathologic picture. The logical inference is that hyperplastic changes are the result of the unopposed action of the estrus hormone. This is purely a deduction and was tested experimentally in the following way: Numerous histologic examinations of human endometria at the various stages of the menstrual cycle were made. This material was compared with material from mice which had been injected with extracts of estrin and extracts of corpus luteum and with a combination of the two. Sections from 28 cases of Swiss-cheese hyperplasia were studied in the light of these comparisons and were found to be similar in many respects to the normal endometrium of the sixth to fourteenth days and to the endometria of animals which had received injections of estrin. The endometria from cases of human hyperplasia were markedly different, however, from the endometria of animals treated with mixtures of estrin and ex-

tracts of corpus luteum, and from the normal endometrium of the premenstrual phase. These observations indicate that the cellular changes of human endometrial hyperplasia are the result of activity of the estrus hormone.<sup>7</sup> However, in none of our experimental animals were we able to produce the characteristic glandular dilatation seen in the human being. It was felt that, while the cellular changes were more important than the glandular dilatation, one must produce both in the same experimental endometrium in order to make a clear-cut demonstration. A further series of experiments was therefore undertaken in which a series of 24 spayed guinea pigs and 24 spayed rats were given varying amounts of estrin over a relatively long period of time.<sup>31</sup> Sections of the uteri were removed at selected intervals during the injection period. A large percentage of guinea pigs which received the estrin injections exhibited uteri in which the cellular and glandular picture was identical with that found in human hyperplasia. The glands, many of which were cystic, were very prominent throughout the greatly thickened mucosa. In rats we have found it more difficult to reproduce the typical Swiss-cheese pattern, although in 40 per cent of our animals the characteristic cystic dilatation of glands has been observed.

The problem of studying the endometrium of patients with Swiss-cheese hyperplasia has been complicated by the fact that it is exceedingly difficult to obtain more than one specimen of tissue in any given cycle. In order to overcome this difficulty we have constructed a small metal cannula the size of a uterine probe which, when inserted into the uterus and attached to a syringe, upon which suction is made, removes sufficient tissue for histologic study.<sup>6, 20</sup> This method of endometrial biopsy by suction has been exceedingly satisfactory from a clinical standpoint. We have observed that many women bleed from an endometrium, which shows all of the characteristics of an estrin cellular reaction but which shows relatively little glandular dilatation. These same patients in other cycles have shown glandular dilatation. We feel that this is a clinical confirmation of the fact that the essential reaction is cellular rather than glandular. In view of these findings, the interpretation of uterine scrapings takes on an entirely different light. Any patient who bleeds abnormally from an endometrium which shows no evidence of progestational proliferation is classified by us as a case of endometrial hyperplasia. In this broad sense, the term endometrial hyperplasia is of course inadequate, as it simply indicates the pathologic end-result of an abnormal physiologic process, the intermediate stages of which are more common and just as important. One naturally asks the question as to how the endometrium of a patient suffering with endometrial hyperplasia is differentiated from that of one in the normal interval phase. This differentiation is ex-

ceedingly difficult from an histologic standpoint and can only be made by establishing the fact that abnormal bleeding is coming from an endometrium which shows no progestational proliferation. This is best determined by securing tissue as near the onset of bleeding as possible.

We have been impressed for a long time with the great frequency of abnormal bleeding following surgery upon the ovaries. In a recent series of experiments, rats were partially castrated.<sup>9</sup> These rats ran a very irregular estrus cycle with prolonged periods of estrus. Similar observations had previously been made by Haterius.<sup>19</sup> The endometrium of these animals, which had a surgical ovarian deficiency and ran a continuous estrus, were very interesting from a histologic viewpoint. We have been able to obtain several typical examples of endometrial hyperplasia by this method, and we feel certain that the excessive removal of ovarian tissue in the human being predisposes to endometrial hyperplasia in later years.

Corner<sup>10</sup> has found in monkeys (*M. rhesus*) that cyclical menstruation may proceed, at least for a limited time, without ovulation or the formation of corpora lutea. We have some data obtained from biopsy specimens which indicates that this may be true in women approaching the menopause.

The cyclical changes of the uterus are dependent on changes in the ovary, and these are dependent upon the secretion of the anterior pituitary. If, for any reason, the supply of the ovarian hormone (folliculin-estrin) is decreased,<sup>25, 2, 24</sup> degenerative changes in the uterus result. This degeneration manifests itself in the human being and in the monkey by genital bleeding. If a corpus luteum is present it results from a progestational endometrium. If a corpus luteum is not present, the bleeding results from an interval endometrium and if follicular stimulation has proceeded for a long period of time, the pathologic picture of endometrial hyperplasia may be present. If for only a short period of time, the endometrium may be of the normal interval type. The bleeding indicates endometrial degeneration, and will vary as to the degree and rapidity of the degeneration. There is evidence which indicates that the degeneration of a progestational endometrium is not similar to that of an interval endometrium.

The essential factor, therefore, in the study of uterine bleeding is not the histologic state of the endometrium but the cause of the endometrial degeneration which results from a decline in estrin.

In a previous paper we have called attention to the fact that the hypophysis affects the ovary, and the ovary, in turn, affects the hypophysis.<sup>8</sup> The nature of this reciprocal relationship is being intensively studied at the present time and will be the subject of a later communication.



Before dismissing the subject, however, we should like briefly to mention the following facts: (1) the ovarian stimulating capacity of the anterior lobe of the hypophysis varies according to the estral cycle, being highest in proestrus and lowest in early diestrus.<sup>30, 11</sup> (2) Removal of the ovarian secretion as a result of castration increases the ovarian stimulating capacity.<sup>13</sup> (3) Crude placental extract increases the ovarian stimulating capacity of spayed rats.<sup>5</sup> (4) Estrin decreases the ovarian stimulating capacity of the anterior hypophysis. While the relationship is admittedly complex, it is nevertheless definite, that the anterior lobe affects the ovary and the ovary affects the anterior lobe.<sup>23, 22</sup>

The cyclical nature of the menstrual function might well be the result of the proper adjustment of this relationship. The evidence indicates that endometrial hyperplasia is only an overgrown and abnormally developed interval type of endometrium, from which pathologic bleeding results. Pathologic bleeding can result from a type which cannot be differentiated from the normal. There is nothing in the histologic picture of these endometria to suggest an especially marked tendency to hemorrhage. Occasional areas of degeneration are found which indicate the origin of some of the bleeding. The functional state of the endometrium is largely dependent on estrin, and an insufficiency of estrin causes the degeneration and the bleeding. The secretion of estrin is dependent on the stimulation of the anterior lobe. How this estrin affects the anterior lobe and causes a cessation of its stimulation is a question yet to be answered.

The literature is full of many excellent articles on this subject. It is impossible to review them all. One article is of especial importance in this connection. Hofbauer,<sup>32</sup> by repeated injections of anterior lobe substance into guinea pigs, produced a definite experimental endometrial hyperplasia. He drew the conclusion that the condition was the result of the excessive stimulation of the anterior pituitary. Frankl,<sup>33</sup> in a paper devoted exclusively to Hofbauer's work, accepts overactivity as the factor in some cases, but thinks that congestion and inflammation of the ovary are more important. We believe that our experiments will do much to clear up the etiology of this condition and reconcile the divergent views.

The surgical and radiologic treatment of endometrial hyperplasia is well standardized at the present time. Either of these methods of treatment may be indicated following the failure of conservative treatment. Their indications have been repeatedly discussed. At the present time reports are appearing, indicating satisfactory results with injections of urinary hebin. This substance is the activator of the ovary in the Zondek-Aschheim test for pregnancy and is made from human pregnant urine. It has been available for some time in

Germany under the name of Prolan. In this country satisfactory preparations are sold under the name of Antuitrin S., Follutein.\* The major portion of our work has been carried out with the former; in a small series of patients good results have also been obtained with the latter.

The origin of urinary hebin has been ascribed to the anterior hypophysis. Recent work<sup>12</sup> casts some doubt on this origin, because urinary hebin is ineffective in the hypophysectomized animal and the amount of ovarian enlargement produced is proportional to the dose only to a certain point. After reaching this point we cannot get greater ovarian enlargement no matter how much is injected. Anterior hypophyseal hormone, on the contrary, gives an ovarian enlargement which is proportional to the dose. The amount of enlargement of the ovaries when the two are given together is greater than the sum of their effects, and this difference is so great as to lead one to believe that there is a specific activation of the anterior pituitary sex hormone by urinary hebin. The source of urinary hebin is not definitely settled, but one should not forget that it is similar in many ways to the anterior pituitary like substance of the placenta. Goldstine and Fogelson<sup>17</sup> have obtained good results in the treatment of uterine bleeding from injections of placental extracts and these were no doubt attributable to the anterior pituitary like substance of the placenta rather than to the estrin in the placental extract.

Since the prolonged bleeding in endometrial hyperplasia is the result of a degeneration of the endometrium, which in turn is a result of a deficiency of estrin, and which in turn is a result of a diminished secretion of the anterior lobe, it is of course apparent that any substance that activates the anterior lobe and starts the secretion again will in turn activate the ovary and check the degeneration in the endometrium, and that when this is accomplished the bleeding will stop. On the basis of this conception we give antuitrin S. beginning at the time of the bleeding and continuing throughout, if we have reason to expect that the bleeding is to be abnormal. If the patient is seen during bleeding, treatment is begun at once; if the bleeding has checked, treatment is postponed until bleeding recurs. While the main action of extracts of urine of pregnant women is directly on the anterior lobe, there is some immediate action on the endometrium, as the bleeding is very frequently increased for a time during the course of the injections.

Engle,<sup>34</sup> in a recent publication, has called attention to a bleeding which occurs in monkeys during injections of extracts of urine of pregnant women. The mechanism of this bleeding is unexplained

\*We are indebted to Parke, Davis & Co. for a generous supply of antuitrin S., and to E. R. Squibb & Sons for a generous supply of Follutein.

at the present time. The similarity to the increase noted with antuitrin S. is suggestive. In developing this type of therapy it was felt at first that the injections of urine of pregnant women would induce the formation of corpora lutea and that the presence of these bodies would regulate the disordered cycle. Geist,<sup>16</sup> however, was unable to produce luteinization of the human ovary with therapeutic doses of this substance. Our own experience<sup>21</sup> in studying biopsies of the endometrium after injections of extracts of urine of pregnant women indicates that the formation of a progestational type of endometrium is not necessary to secure a satisfactory result.

### CONCLUSIONS

1. The histologic changes indicative of endometrial hyperplasia are due to the action of the estrin hormone.
2. Pathologic bleeding may result from all stages of the estrin type of endometrium.
3. The important diagnostic point is the determination of pathologic bleeding coming from an interval type of endometrium. This can best be accomplished by obtaining tissue near the onset of bleeding.
4. The removal of ovarian tissue predisposes to the development of endometrial hyperplasia in later years.
5. Bleeding in endometrial hyperplasia cases results from a decline in estrin as a result of diminished anterior pituitary secretion.
6. The hypophysis affects the ovary and the ovary affects the hypophysis. The proper adjustment of this relationship has much to do with the periodicity of the cycle.
7. In the final analysis, endometrial hyperplasia is a disorder of this hypophyseal-ovarian relationship, resulting in abnormal and irregular declines in the amounts of estrin and anterior pituitary hormones available.
8. Urinary hebin produces satisfactory results in the treatment of these cases.
9. Its action is probably the result of anterior lobe stimulation. The cause of the increased bleeding during the injections and in the experiments of Engle is unexplained.
10. It is not necessary to provoke luteinization of the ovary and a progestational endometrium in order to secure good results.

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The treatment of eclampsia in the cases reviewed was chiefly conservative. Among 48,053 deliveries there were 282 cases of eclampsia (0.6 per cent). The total maternal mortality was 7.8 per cent and the entire fetal death rate 31 per cent. The maternal mortality for the eclampsia cases during pregnancy was 9 per cent, during labor 7.1 per cent and during the puerperium 8.3 per cent. Delivery was spontaneous in 40 per cent of the cases. Only 2 abdominal and 5 vaginal cesarean sections were performed. Venesection is being used more and more and was employed in 71.4 per cent of the cases during the years 1924-1928.

There were 1,149 cases of preeclampsia. Among 90 treated for more than twenty-four hours before delivery the maternal mortality was 4.4 per cent and the fetal death rate 30.2 per cent. Eclampsia developed in 8.7 per cent of the cases and delivery was spontaneous in 60 per cent. Among 59 cases treated less than twenty-four hours before delivery the maternal death rate was 6.7 per cent and the fetal rate 14.5 per cent. Spontaneous delivery occurred in 79.7 per cent.

Among 670 patients with nephropathy, 2.5 per cent developed eclampsia. Of 188 treated for more than twenty-four hours before delivery 1.06 per cent died and of 482 treated for less than twenty-four hours before delivery none died.

J. P. GREENHILL.

# A NAEGELE PELVIS WITH COINCIDENTAL DEFORMITIES OF GENITAL TRACT AND EXTREMITIES\*

(From the Department of Obstetrics, University of Tennessee)

JAMES R. REINBERGER, M.D., MEMPHIS, TENN.

SINCE roentgenologic examination has become an integral part of the investigation for cases suggesting abnormalities, many more cases of obliquely contracted pelvis have been reported. Nevertheless the paucity of the particular type of obliquely contracted pelvis here described is sufficiently marked to justify this detailed study.

Mrs. L. S., white, aged nineteen, gravida i, was admitted to the prenatal clinic of the University of Tennessee, June 1, 1927, about six months pregnant.

The patient had had measles, mumps, and whooping cough. In early life she was told by her parents that physicians thought her left hip dislocated. She began to walk at two years of age. At twelve years of age an attempt was made to straighten the left foot, which was markedly clubbed. Following this operation the application of a plaster cast resulted in gangrene. This in turn was followed by amputation of this leg in the lower one-third. The right foot was not as deformed as the left; but had several digits which gave considerable discomfort for about five years. Upon this right foot nine operations were performed to remove the extra digits, plus the attempts for straightening the moderately deformed clubbed foot. At the age of fourteen years the last operation was performed for the removal of a bunion, and was followed by osteomyelitis. For some unknown reason this necessitated amputation of the lower third of this right leg about one and one-half inches lower than that performed on the left. Following the amputation no further trouble was encountered. Artificial limbs have been worn constantly.

Patient married two years. No precautions. Last monthly period Dec. 15, 1926, date of confinement Sept. 22, 1927.

The standing clothed individual presented no apparent abnormalities, except a slightly drooping left shoulder and a more prominent left hip. She walked with no particular difficulty and certainly not to the extent that one would suspect her of using artificial limbs (Fig. 1). She stood in artificial limbs, which reached to the upper one-third of both extremities. Closer inspection from the front, revealed a marked tilt of the entire upper part of the trunk to the left side. The left hip was decidedly higher than the right. Both hands were normal, except for an extra digit on the right thumb. From every view the position of the arms presented the form of a tight-rope walker with a balancing pole. I assume that it was this same position of the arms which gave the patient some ease in standing or walking.

It was obvious at once that the hair line of the mons veneris pointed to the left of the median line. The crotch was held firmly together, possibly in an attempt to establish an equilibrium of the artificial legs. The skin surface presented no scars that would point to any old inflammatory lesion.

From the back view of the patient (Fig. 1), the left hip was seen to be decidedly higher than the right. There was considerable left scoliosis. The but-

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tocks were asymmetrical, the left being distinctly larger than the right. To account for this, there was a distinct protrusion beginning slightly to the left of the median line just above the junction on the two lips of the buttocks and extending to the body curve of the left iliac crest. This mass was firm, immovable and stood about 4 cm. above the body surface. It measured about 6 times 8 cm. The skin surface, likewise, presented no scars. The removal of the artificial limbs revealed a bilateral amputation in the lower third of both legs.

The thighs could be flexed and widely separated, showing absence of ankylosis of the hip joints. The vulva seemed unusually close to the narrow pubic arch. Separation of the labia majora revealed a vagina divided by septum which at first

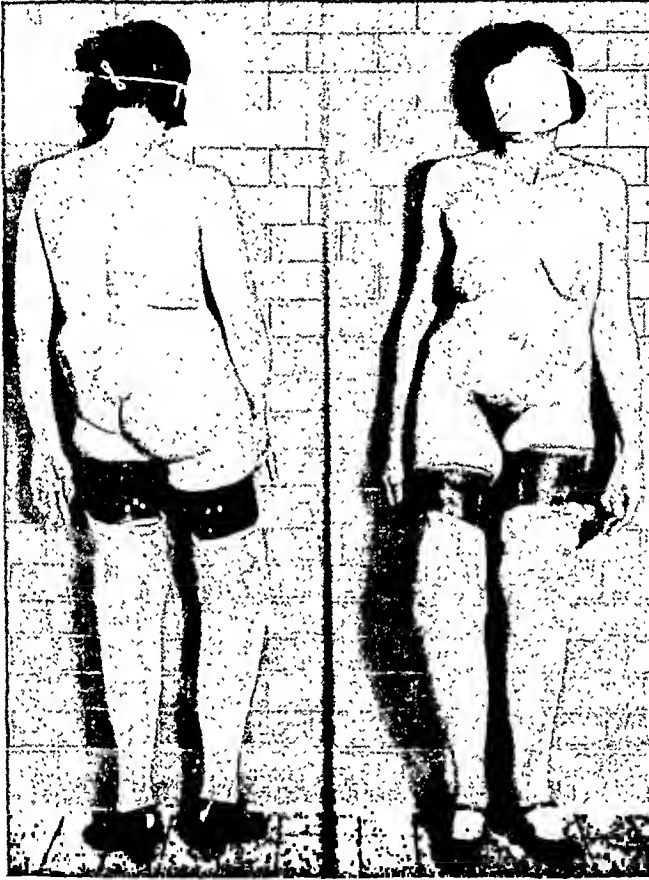


Fig. 1.—Front and back view, showing artificial limbs. Tilt of body.

glance appeared to be transverse. In reality it was a well-formed, normal longitudinal septum, extending from the vulva to the cervix. The axis of the vagina had been rotated to the right to such a degree that one vagina in its lower third was superimposed upon the other, rather than parallel. Two distinct softened cervixes were present. The right was infantile; the left, normal in size or maybe slightly hypertrophied, was on the pregnant side. The pubic arch was not vertical, but was likewise rotated to the left so much so that if the diagonal conjugate was drawn from the promontory directly anterior, it would strike the pubic bone about 2 cm. to the right of the pubic arch. The transverse diameter of the outlet was slightly contracted and measured 7.50 cm. The posterior sagittal was markedly increased due to the flaring out of the sacrum. The sacrum had lost its normal curve and was almost straight. The right iliopectineal line had a markedly exag-

gerated pelvic curve, particularly of the ascending ramus of the pubis. The left iliopectineal line extended straight back. The two sacroiliac joints revealed a firm synostosis. The left iliopectineal line shaded almost directly into the promontory of the sacrum. The real diagonal conjugate was shortened; but there was sufficient room in a 12 cm. false diagonal conjugate drawn from the promontory to the widest point in the curve of the right pubic bone.

The pelvic measurements determined by roentgenograms were as follows: between spines 26 cm., between crests 27 cm., external conjugate 22 cm., diagonal conjugate 9 cm., true conjugate 7 cm., left oblique 25 cm., right oblique 18 cm.



Fig. 2.—X-ray showing the oblique deformity. Scoliosis to left or deformed side. Note the absence of hip joint disease.

The special measurements advised in the original Naegele description are as follows: from tip of spinous process of last lumbar to left anterior superior spine, 21 cm.; from tip of spinous process of last lumbar to right anterior superior spine, 15 cm.; from center of sacrum to right sacroiliac joint, 7 cm.; from center of sacrum to left sacroiliac joint, 6 cm.

The flat picture of the patient with the x-ray directed into the inlet (Fig. 2) in the sitting position gave the impression that the left iliac bone was atrophic, in that only one surface (anteroposterior) was evident. But realizing the extreme angle at which the ilium was placed to the middle of the pelvis, it became appar-

ent that it was impossible to show the inner surfaces of both iliac at the same time. This same flat picture showed that there was an abnormal position of the sacrum and coccyx, both deviating with considerable curve to the left of the median line. The coccyx, however, was more angulated than was the sacrum. The left iliopectineal curve was absolutely obliterated. The left innominate bone was displaced upward, backward, and inward. The left sacroiliac space was more dimin-



Fig. 3.—X-ray sacroiliac joints. Scoliosis to left side. Higher compensatory scoliosis to right.

ished than the right. The left ischial spine was distinctly closer to the midline of the pelvis and displaced upward. The left sacral ala was very much smaller than the right and was apparently firmly attached to the ilium. It could not be told from this view whether the sacrum, ilium, and sacral ala were in direct apposition. There was haziness of the fifth lumbar vertebra, but nothing abnormal could be determined from this view.



The most outstanding point of interest in a lateral x-ray view of the pelvis was some definite osseous tissue which apparently had no, or a questionable, connection with the body of the sacrum. This conforms with the protrusion mentioned on the posterior surface of the left sacroiliac joint. The sacrum was straight and was flared out posteriorly. There was an additional malformation of the other sacral bodies in the form of a bifidsacrum. The last lumbar vertebra was deformed, but it was not clear enough to absolutely ascertain the exact defect.

The x-ray of the spinal column revealed a marked compensatory scoliosis toward the left or a diseased side (Fig. 3). This scoliosis was further compensated by a higher one to the right side. The sacroiliac joint at this level cannot be studied. This plate was taken from the posterior surface of the body.

The patient attended the clinic at regular intervals. She was free of any symptoms and gained only twenty pounds. The blood pressure and urine remained negative. Wassermann was negative. It was decided to give this patient a chance at spontaneous delivery, as there was ample room on the right side of the pelvis.

She was admitted to the hospital Sept. 18, 1927, with a history of having had regular pains with increasing intensity for twelve hours. The cervix was about one and one-half fingers dilated. The presenting part was not engaged. The x-rays revealed a moderate-sized baby with no cephalic engagement. The labor was terminated by a classical abdominal cesarean section under local and gas anesthesia. A male child (6 pounds 4 ounces) was extracted and breathed spontaneously. The uterus was closed with two layers of interrupted No. 2 chromic sutures and a third continuous No. 2 plain inverting musculo-peritoneal catgut suture. The uterus presented a distinct sulcus and a very much smaller right horn. The finger could not be passed into this smaller horn. Only one cervix could be palpated.

*Diagnosis.*—A diagnosis of uterus septus with a double cervix and a double vagina was made. Tubes and ovaries were normal, as were, likewise, the round ligaments. The abdomen was closed. The patient nursed her baby and made an uneventful recovery and was discharged on the sixteenth day postpartum. She was reexamined at the six weeks' postpartum clinic, and when we confirmed the original findings, she was discharged.

She was not seen again until Jan. 5, 1930, when she entered the Methodist Hospital about three months pregnant. Based on her physical and economic conditions, as well as a general debility, which had developed during the interim, I decided to terminate the pregnancy and sterilize. With proper consultation I terminated the pregnancy by abdominal hysterotomy Jan. 30, 1930, under local and gas anesthesia. To confirm my previous diagnosis, an incision was made into the nonpregnant horn which was in the same side as her previous pregnancy. The diagnosis was confirmed. Tubal sterilization was carried out by the Irving's method. The patient made an uneventful recovery and was discharged on the tenth day postpartum.

#### COMMENT

I am still doubtful whether or not this pelvis could be classified as a true Naeglele. Most textbooks and all articles discussing Naeglele pelvis stress the fact that there is always absent the history of limp, difficulty in walking, hip joint disease, and moreover, many of the cases for this reason are overlooked as the majority deliver spontaneously. In this case there is a history of bilateral club foot. But the child walked at a fairly normal period of life. Likewise, because of the deformities of the extremities it cannot be said that these actually produced the deformity of the pelvis, in so far as there are distinct deformities of the sacrum and lower spine. Even though this patient did have club foot, it is not

unlikely that this pelvic deformity would have resulted from the defects in the body of the sacrum, the left sacral ala, and the lower lumbar spine.

Aside from the inlet deformity which was typically an obliquely contracted obviolate, there was a distinct pelvic outlet of the true Naegele's form. The vertical axis of the pubic arch was rotated to the diseased side. The ischial spine was distinctly closer to the midline of the pelvis, as was the iliopectineal line. In fact, the entire left half of the pelvis was in favor of a Naegele's type, in that, the entire wall of the left pelvis was pushed upward, inward, and backward on the diseased side. This was a contradistinction to a coxalgic pelvis resulting from hip joint disease in which the deformity was produced on the normal side to relieve the strain and weight of walking from the diseased side. The left leg was more deformed and caused more trouble in locomotion than did the right. If this were a coxalgic pelvis, the deformity should be found on the nonaffected side.

Furthermore, the displaced backward and straight sacrum was of significance. If this deformity had its origin in rickets, sufficient to cause this marked distortion, then you would expect a much more flared-out position of both ischial tuberosities. But such was not the case, because the pubic arch was actually narrower than a normal pubic arch. It must have resulted from compression inward by the weight of the body. I think the deformity of the sacrum resulted more from a malformation of the fifth lumbar vertebra. Furthermore, there was a low lumbar scoliosis pointing to the diseased side, which was always characteristic of a Naegele's pelvis. The second scoliosis simply compensated for the lower one. Dr. Williams, in his most excellent manner, reported a true case of Naegele's pelvis in 1929. He was fortunate enough not only to examine his patient during life; but also to obtain the pelvis at postmortem. Dr. Williams stated, "that his interne overlooked his note of this deformity in her previous hospital history and also inferred that this oversight probably occurred from the fact that the patient had always had spontaneous deliveries in her six previous pregnancies. During this last delivery the tragic dystocia was encountered, which necessitated version and manual extraction of the placenta."

The absence in the history of any inflammatory process with the lack of evidence of gross bone pathology, absolutely rules out any inflammatory origin that might have resulted in this oblique contraction. Then if this be termed a Naegele's pelvis it is unquestionably not of inflammatory origin. Those who insist that embryologic pelvic defects are the etiologic factors, have their claim further substantiated by the deformities of the sacral body, sacral ala and other associated deformities of the female generative tract, plus the deformities of the lower extremities and the supernumerary digits of both upper and lower extremities. Furthermore, I am inclined to believe that this misplaced piece of bone posterior to the sacrum is the undeveloped sacral ala; because it actually conforms in shape, size, and thickness to one or more segments of a normal sacrum. Therefore, in closing, I wish to repeat that while in certain particulars I have not been able to satisfy myself that this is a true to form Naegele's pelvis, yet it is allied. I am confident that this unusual type of oblique deformity is a primary embryologic defect and that the associated lower extremity deformities are purely coincidental. Gross examination of the pelvis could only decide the question of classification.

## THE TEST OF LABOR\*

LOUIS RUDOLPH, M.S., M.D., F.A.C.S., CHICAGO, ILL.

(*Attending Obstetrician, Cook County Hospital*)

THE term "test of labor" has been variously defined and has markedly different connotations among obstetricians at the present time. The criteria of the "test of labor" have not been standardized. This statement is borne out by the literature and particularly by the discussion which followed the paper by Harold Bailey<sup>1</sup> at the 1926 meeting of the American Gynecological Society. Since the medical profession looks to the obstetric specialists to formulate the criteria of the "test of labor," and since the "test of labor" so frequently predetermines operative interference with its incident maternal and fetal morbidity and mortality, it is certainly desirable that the obstetricians define, or establish once for all the criteria of the "test of labor."

The "test of labor" has obviously both anatomicophysiologic and clinical aspects. This is true because the anatomy of the pelvis and of the fetus is concerned on the one hand, and the clinical picture of the mother on the other. Both aspects should be considered and properly evaluated, and one should not be emphasized at the expense of the other. The viewpoint of the present day obstetricians in regard to the criteria of the "test of labor" may be divided into two schools, namely, the "anatomicophysiologic" and the "clinical." Those who belong to the anatomicophysiologic group maintain that the "test of labor" should begin only after complete dilatation of the cervix, rupture of the membranes, and a given number of hours of "second stage labor." Among those who have subscribed to these criteria are Schauta,<sup>2</sup> De Lee,<sup>3</sup> Williams,<sup>4</sup> Edgar,<sup>5</sup> Cragin,<sup>6</sup> Holmes and Burdick,<sup>7</sup> Bumm,<sup>8</sup> Kerr,<sup>9</sup> Eden and Holland,<sup>10</sup> Solomons,<sup>11</sup> Commandeur,<sup>12</sup> Brouha,<sup>13</sup> Goodall,<sup>14</sup> Beck,<sup>15</sup> Danforth and Grier,<sup>16</sup> Maxwell,<sup>17</sup> and Longaker.<sup>18</sup>

Those who belong to the "clinical school" define the "test of labor" as a variable number of hours of "strong pains," some taking into consideration the failure of the head to engage, and others the clinical condition of the mother or fetus. Bailey<sup>1</sup> writes, "The trial labor was conducted by allowing the patient to have twelve hours of strong pains without vaginal or rectal examinations. If at the end of this time the head was floating, a low flap section was performed." Lull<sup>19</sup> states that if, "after a test of labor averaging eight hours, there is no attempt at engagement, section is done." Hirst<sup>20</sup> gives a primipara twenty-four hours, and a multipara twelve hours from the beginning of really strong labor pains. He watches

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the patient in regard to pulse, temperature, and respiration, stating that a great deal of individualization is required. Newell<sup>21</sup> writes that in some cases "a few hours' trial will give a strong hint as to the probable outcome," and again writes "of course the result of labor cannot be accurately predicted in a certain proportion of cases until the patient has had a *true test of labor*, i. e., two hours or more in the second stage of labor." Stein and Leventhal<sup>22</sup> sum up the prevailing idea and their attitude in regard to a test of labor as follows: "What constitutes an adequate test of labor is a matter of dispute and must be decided after a careful study of each individual case." Quigley<sup>23</sup> uses a test of labor which varies from five to ninety-six hours. Laferty<sup>24</sup> follows Tweedy's method in which the maternal pulse and temperature (a rise above 100°) and the fetal heart tones (a rise above 160 or falls below 120 on three consecutive counts at one-minute intervals) are the chief criteria. Baer<sup>25</sup> states that the criterion for a cesarean section is not complete dilatation of the cervix, but is dependent upon the experience of the obstetrician. Courtiss and Fisher<sup>26</sup> indicate that their test of labor varied from one to one hundred and twenty hours. Kreis<sup>27</sup> states that the test of labor may be limited to ten hours at the maximum after which time one can decide whether the labor will be terminated abdominally or vaginally.

It appears that the number of hours the mother has been in "ineffective labor" is an important criterion to a number of those obstetricians who belong to the "clinical school." I wish to indicate and emphasize that the number of "hours in labor," "hours of pains," or "strong pains" is not an accurate criterion for a "test of labor." Although the uterus may contract and produce a pain sensation, it does not follow that the contraction is effective in effacing and dilating the cervix, and in propelling the presenting part downward. By analogy the gastrointestinal tract manifests two types of motility, a propulsive and a nonpropulsive type. Contractions may occur without resulting in propulsion of the contents. Similarly the uterus may manifest these two types of motility. We know that the uterus in labor is divided into the upper and the lower uterine segments with the ring of Bandl as a ridge dividing the two. Normally this division of the uterus is dependent chiefly upon the upper segment, because of its extremely significant property of isometric or sustained contraction or shortening. This property of sustained contraction of the muscle fibers of the upper segment makes possible "retraction," thickening, or "capping," and prevents the loss of the advantage gained by each sustained uterine contraction. In other words the muscle fibers of the upper or active segment not only must contract, but must relax incompletely or manifest sustained contraction in order to bring about retraction and the consequent effacement and dilatation of the cervix. During the first and second stage of labor the lower or the relatively passive segment must manifest the opposite property, namely, relaxation or the ca-

capacity to be stretched. This difference in the functional motility of the two segments brings about the canalization of the cervix uteri.

The first stage of labor or the opening-up of the lower pole of the uterus is purely a mechanophysiologic process of the uterus itself. The fetus is relatively stationary during the first stage of labor,<sup>4, 5, 6, 9, 28</sup> and the uterus per se brings about effacement and dilatation of the cervical canal by the "uterine pull," which is exerted primarily on the cervix uteri. At the beginning of the second stage of labor the "uterine pull" is transferred to the bony pelvis primarily through the attachments of the endopelvic fascia and the vaginal walls, which is associated with the phenomena of "bearing-down." With the onset of the second stage of labor the vaginal walls become taut, forming the uterovaginal canal. At this stage, descent of the ovoid begins, and proceeds as the upper segment becomes more and more thickened or "capped" with each succeeding uterine contraction. Each uterine contraction is directly associated with a decrease in the uterine cavity and a descent of the ovoid.

These physiologic considerations of the uterus in labor suggest that we may be overestimating the importance of cephalopelvic disproportion, especially, if we do not give the head an opportunity to mold in the borderline cases. It is possible that many of our prolonged labors with floating or high heads are due to a disturbance of the physiology of the uterus in the first stage of labor. Physiology compels us to recognize that a disturbance of the properties of the upper and lower uterine segments is a factor that must be considered in our obstetric practice.

What is the nature of this disturbance which lessens the effectiveness of the uterine contractions? If the musculature of the upper uterine segment does not manifest the normal phenomenon of isometric or sustained contraction on which retraction depends, the effectiveness of the uterine contraction or "labor pains" is practically nil in that no thickening or retraction of the upper uterine segment occurs, the ring of Bandl does not rise, the lower segment is not stretched or thinned, and an arrest in the canalization of the cervix uteri results. In other words, the uterine musculature may merely contract and relax. There may be no retraction. Consequently the normal physiologic changes in the uterus do not take place. This condition of uterine dysfunction may occur at any stage of labor. It may appear at the onset of labor (false labor), or the uterine contractions may begin normally, and then change to uterine dysfunction. Since in my experience uterine dysfunction is practically always a temporary condition, I believe that cervical dilatation is the "barometer" of the physiologic motor activity of the uterus during the first stage of labor. The Schatz-Unterberger method which demonstrates the rising ring of Bandl determines usually the dilatation of the cervix and the physiologic motor activity of the uterus. This concept of uterine dysfunction is important, because in a case of prolonged labor with incomplete cervical

dilatation and no cephalopelvic disproportion, malposition, malpresentation, previous section, or organic cervical pathology, it assures us that rupture of the normal uterus will not occur irrespective of the number of hours in labor.

This presentation of the physiologic facts obviously supports the viewpoint of the "anatomicophysiologic school" because it emphasizes the importance of the phenomena of isometric or sustained contraction, manifested by the upper uterine segment, and its relation to the formation of the uterovaginal canal. It should be obvious that the number of hours of "labor pains" does not necessarily represent effective uterine contractions. It is necessary to differentiate between effective and noneffective uterine contractions, between true and false "labor pains." The only differentiating point known at the present is the degree of effacement and dilatation of the cervix, or the rising of the ring of Bandl.

Whether the absence of the property of isometric or sustained contraction of the muscle fibers of the upper uterine segment per se is the sole cause of the uterine dysfunction, we cannot state, because its absence may be a part of the picture of incoordination between the upper and the lower uterine segments. This syndrome is indicated clinically by an arrest or a prolongation of effacement and dilatation of the cervix. At the present time unfortunately, we have no drug or procedure with which to treat the musculature of the upper uterine segment when it fails to manifest the phenomenon of isometric or sustained contraction, the property of the uterine contractions which renders propulsion of the ovoid possible.

The author will avoid the use of statistics in general to demonstrate this point, because their interpretation depends so much on individual views, while fundamental principles are more important and lasting. However, in one phase of operative interference a brief generalization of statistics is pertinent to this discussion. In cesarean section the maternal mortality ranges from 2 to 25 per cent and higher. This does not take into consideration the resulting sterility and postoperative sequelae, the increased risks in future pregnancies and labors, and a fetal mortality which ranges from 4 to 30 per cent. With an increase in cesarean section, we must realize that as a result of undue haste in terminating labor, operative interference per vaginam has, also, increased. We can only speculate concerning the statistics on this phase of operative interference. It is possible that we may be able to decrease the incidence of operative interference by formulating and adopting a safer and more rational "test of labor." Less haste in terminating labor will result in greater safety for the mother and child.

The "anatomicophysiologic school" has formulated a "test of labor" which is specific in its requirements. Where does the "clinical school," the new trend in obstetric thought lead us? It becomes necessary to deter-

mine whether or not its dicta are responsible for the increase in operative interference.

In all branches of medicine the basis of teaching should be the basic sciences, especially physiology. During the White House Conference on Child Health and Protection, Findley<sup>29</sup> and Arey<sup>30</sup> emphasized the necessity of a better correlation between the teaching of the basic sciences and the teaching of obstetrics. Ehrenfest<sup>31</sup> writes, "Artificial delivery is becoming increasingly frequent, especially in hospital practice. One of the factors is an exaggerated idea of the value of the infant's life, and the often false idea that artificial delivery is easier on the mother, incidentally an idea which complies with the present demand of women for short labor."

The basic principles underlying the proper management of a parturient is the knowledge of the normal physiology of the uterus in labor. When a disturbance of the physiology occurs we should recognize the underlying changes clinically, and treat those changes conservatively in spite of the fact that our specific knowledge of the underlying etiology is scanty. The "clinical school" bases its "test of labor" upon the number of hours in labor, the subjective character of the pains, and the individualization without regard to the anatomicophysiologic conditions present.

This viewpoint raises a number of interesting questions relating to the mechanism of labor based on mechanical and physiologic principles. (1) Why is the effacement and dilatation of the cervix prolonged in some cases? (2) Is the designation of labor pains as "weak" or "strong" of accurate clinical value in a "test of labor"? (3) At what stage of labor does molding and compression of the head take place? (4) Why does the presenting part remain floating or high in some cases when no cephalopelvic disproportion, malposition, or malpresentation is present?

The first two questions are based on the physiology of a uterine contraction. If during a uterine contraction the upper segment does not manifest sustained contraction or retraction, and the lower segment does not stretch or thin, the uterus is not performing physiologically. A labor pain is a subjective manifestation of a contraction of the uterus, and the subjective response of a patient to a labor pain depends upon the emotional state and the degree of sensitivity of the pain nerve endings in the uterus which may vary in different patients and in the same patient from time to time. To the author the designation of a labor pain as "weak" or "strong" is of neither clinical nor physiologic value. When the labor pain effects no progress in effacement and dilatation of the cervix, it means that the upper segment is not undergoing retraction and that the lower segment is not stretching or thinning. This is designated as uterine motor dysfunction, and explains the clinical phenomena. The author has pointed out above that the "uterine pull" in the first stage of labor is exerted chiefly on the cervix uteri, and is transferred to the bony pelvis in the second

stage of labor. It is at this stage that descent of the ovoid really begins, and that molding and compression of the fetal head occurs as it is forced to overcome the resistance of the inlet and the cavity of the pelvis by the normally contracting uterus. Even in cephalopelvic disproportion the physiologic progression of motor activity of the uterus cannot be disturbed markedly until the second stage of labor.

In regard to the fourth question, it is well known that the presenting part may be floating or high during the first stage and early part of the second stage of labor whether cephalopelvic disproportion is present or absent. Rudolph and Ivy<sup>32</sup> have indicated that it is due to an incoordination of the uterus in that the lower uterine segment is slow in forming, which is a temporary condition in the majority of instances. It is frequently true that floating or high heads with no cephalopelvic disproportion are associated with prolonged labors. In the author's experience the expectant plan of management will result in the descent of the head and a successfully terminated labor an experience which has been reported by Harrar<sup>33</sup> and Carey and Casagrande.<sup>34</sup>

If I interpret the viewpoint of the "clinical school" correctly, it is based solely upon extensive obstetric experience. Hirst,<sup>20</sup> Stein and Leventhal,<sup>22</sup> and Baer,<sup>25</sup> stress the factor of individualization of each case and obstetric experience. Bailey,<sup>1</sup> Lull,<sup>19</sup> Quigley,<sup>23</sup> and Courtiss and Fisher,<sup>26</sup> base their "test of labor" upon a certain number of hours in labor and upon the character of the pains. Laferty<sup>24</sup> and others base the "test of labor" upon the maternal and fetal condition. A fact to be noted in the above references is that the authors quoted are obstetric specialists who have developed obstetric judgment. After extensive experience their judgment will undoubtedly take into consideration the underlying principles of the "anatomicophysiologic school" in evaluating the indications for the management of a given case. I do not question the obstetric judgment of the "clinical school." But is their position fully justifiable? Should we not define the "test of labor" according to the "anatomicophysiologic school" and add that only extensive obstetric experience permits the definition to be qualified? Can we teach the "clinical test of labor" to the undergraduate and the general practitioner?

The physiologic considerations enumerated above do not conform with the criteria of the "clinical school," because the normal and the abnormal states of the uterine contractions and the physiology of the first and the second stage of labor are not considered properly and evaluated. The subjective interpretation of a "labor pain" is no index of the underlying changes of the uterus. I believe, therefore, that the character of "labor pains" cannot be used as a criterion for a "test of labor." Normal uterine contractions bring about certain changes in the uterus that can be determined relatively only on examination of the cervix or by the Schatz-Unterberger method. This can be proved by a study of frozen sections,



and in cesarean section by the state of the upper and the lower uterine segments, and the location of the ring of Bandl.

Scientific obstetrics dates from Levret<sup>35</sup> who in 1642 established the so-called "obstetricomathematical school" which fashioned obstetric thought in a mechanical sense. It appears to me that we have overemphasized the importance of cephalopelvic disproportion when in reality the majority of our dystociae are due to the anomalies of the powers of labor or uterine dysfunction. In a recent paper, Wilson<sup>36</sup> writes that disproportion is the reason usually given for performing cesarean section, when the cause may correctly be ascribed to imperfect functioning of the uterus, an opinion fully shared by the author. Williams<sup>4</sup> writes that cesarean section should not be done in cases in which the cause is due to an incoordination of the uterus. Although section may save the child, it will expose the mother to an unjustifiable risk. Cervical dystocia is a manifestation of uterine dysfunction, and Baudelocque,<sup>37</sup> Cazeaux,<sup>38</sup> and Hodge<sup>39</sup> wrote that no resort to artificial delivery should be made in these cases; while De Lee<sup>40</sup> writes that cesarean section is justifiable in these cases after eight or ten hours without cervical dilatation.

For the purpose of teaching it appears to the author that the "clinical school" attempts through their art, developed by extensive experience to anticipate what may occur, instead of giving the medical profession definite criteria on which to base a "test of labor." In teaching obstetrics, the author is firmly convinced that we should be uniform and teach the basic principles underlying the "anatomicophysiologic school's" definition of a "test of labor." The criteria of the "clinical school" should be reserved for the obstetric specialist who has gained obstetric judgment. This is exemplified by De Lee<sup>3</sup> who in his textbook adheres to the definition of the "anatomicophysiologic school," which is intended as a guide for the student and the general medical profession, but who in his own practice may determine a "test of labor" based on his obstetric judgment.<sup>41</sup> Lull<sup>42</sup> has recently expressed this view by stating that the undergraduate should be taught the most conservative type of obstetrics, while the obstetric specialist may be governed by his obstetric judgment. The medical profession is influenced greatly by the lectures and publications of the obstetric specialists and teachers and too frequently follow a method or opinion that has been developed and used only after years of specialized experience.

The author is of the opinion that if the anatomicophysiologic criteria of a "test of labor" only are taught and due emphasis placed upon them in all papers on the subject, there will result a decrease in the incidence of operative interference and a corresponding decrease in the maternal and fetal morbidity and mortality. The indication in the main for cesarean section should be determined as a primary operation before the onset of labor, as was emphasized by Grandin<sup>43</sup> and Reynolds.<sup>44</sup> During the pre-

natal period a study of the stature of the patient and pelvimetry gives us a relative idea of the pelvis. From the thirty-sixth to the fortieth week of pregnancy the cephalopelvic relation may be determined by the impression methods of Muller-Pinard, Monroe Kerr, and Hillis, which if necessary may be carried out under anesthesia. Before the onset of labor a diagnosis should be made on the manner of delivery based upon an absolute, a relative disproportion, or a normal cephalopelvic relation. During the course of labor the functional activity of the uterus should be diagnosed as normal or uterine dysfunction.

In the presence of a diagnosis of an absolute disproportion and of a normal cephalopelvic relation, the indications for the management are definite. In the presence of a relative disproportion or in a "border-line" case, it becomes necessary to evaluate the conditions present and to determine the method of delivery, abdominal or vaginal. If the vaginal route is elected, then in the majority of instances the abdominal route is closed, and the patient is given a "test of labor" which may be terminated by forceps, pubiotomy, cesarean section, or craniotomy; and occasionally by either a Porro or Portes cesarean section. This method of management by the medical profession, will I believe generally be safer for the mother and child, except the craniotomy on the child. In the majority of border-line cases, we should not consider deflexion attitudes as a mechanical result. Rudolph and Ivy<sup>45</sup> have indicated that the deflexion attitudes and arrested or prolonged internal anterior rotation of the presenting part are primarily due to an incoordination of the uterus; so even if this occurs in a given case, it may be corrected in the second stage of labor by manual or forceps reposition or by an early version and extraction.

Exhaustion is frequently stressed as a complication in prolonged labors due to uterine dysfunction. The author is firmly convinced that exhaustion is most often due to improper management of the parturient. Exhaustion is caused by either psychical or physical factors. If the patient is prepared for the ordeal of labor and her physical condition properly treated by periods of rest and a normal intake of food and liquids for each twenty-four hours of her labor, particularly in a so-called "test of labor" when the prolonged labor is due to uterine dysfunction, exhaustion will be infrequent in occurrence.

#### SUMMARY

1. The "test of labor" is an important and fundamental obstetric term based on definite physiologic changes in the uterus and should be thoroughly understood by the novice in obstetrics.
2. The diagnosis and management of the border-line cases of cephalopelvic disproportion should be taught thoroughly to undergraduates at the expense of some of the more highly technical and specialized methods for operative interference.

3. The "anatomicophysiology" definition of a "test of labor" should be accepted as a standard definition to be qualified and departed from in practice only by the obstetric specialist who has gained obstetric judgment after an extensive experience.

4. The statistics on operative interference reported by obstetric specialists do not indicate the correct morbidity and mortality, because most cesarean sections are performed by general surgeons. By reason of his personal influence and progressive ideas, Mosher<sup>46</sup> has pointed the way out. He has succeeded in convincing the general surgeons in his community to consult the obstetric specialist for the indication for cesarean section.

5. In the capacity of obstetric specialists and teachers it will be to the advantage of our womanhood, if we impress upon the undergraduates and the medical profession generally the fact that the proper time for obstetric consultation is before the onset of labor.

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# FURTHER STUDIES IN THE TREATMENT OF PUERPERAL SEPTICEMIA (AND) OTHER BLOOD STREAM INFECTIONS WITH METAPHEN

J. B. BERNSTINE, M.D., F.A.C.S., PHILADELPHIA, PA.

(*From the Department of Obstetrics Jefferson Medical College*)

NOTWITHSTANDING the great strides that have been made in the treatment of disease, septicemia continues to exact an appalling toll of morbidity and mortality. Thus, according to the figures quoted by Bland,<sup>1</sup> who has made a careful study of the maternal death rate, the maternal deaths recorded in the registration area in the United States alone during the period from 1915 to 1926 inclusive aggregated 174,385, and of this number 70,746 died of septicemia. If to these figures are added the deaths resulting from septicemia not due to obstetric causes, in children as well as adults, the seriousness of the problem will be fully realized.

While many drugs and methods of treatment have been used, none has proved to be entirely effective. The chemotherapeutic mode of attack has chiefly centered around attempts to find a drug which would destroy the offending organism in the blood stream. It has been pointed out by Kilduffe,<sup>2</sup> however, that the bacteriostatic action of the drug introduced into the blood stream may be at least as important as its bactericidal effect. In order to understand the reasons for this thesis, one must consider the various factors underlying a bacterial infection of the blood stream. It is common knowledge that an initial focus is always present in such infections. The invading organisms enter the blood stream from this focus intermittently; thus, according to Trout,<sup>3</sup> the peripheral circulation may be entirely free from bacteria which are, nevertheless, at the same time present in large numbers in the spleen, liver, and bone marrow. It is, therefore, possible for peripheral blood cultures to change from negative to positive within a few hours; this situation is usually described by saying that the bacterial invasion takes place in intermittent "showers." Further, the importance of the natural defenses of the organism must be emphasized; these include filtration by the lymph glands, formation of antibodies, and phagocytosis.

It is argued by Kilduffe, therefore, that greater weight should be placed on the bacteriostatic properties of drugs intended to combat septicemia; for it is doubtful whether a bactericidal agent can ever be found of such low toxicity that a quantity sufficient to destroy all the microorganisms present could be safely introduced into the blood

stream; on the other hand, a much smaller quantity of a chemical compound may be bacteriostatic, i.e., it will inhibit the growth and activity of bacteria in the blood stream, and thus reinforce the defensive mechanism of the organism sufficiently to overcome the infection.

It was, therefore, natural to consider metaphen in this connection because of its high bacteriostatic action, as found by Raiziss and Severac<sup>4, 5, 6</sup> and Birkhaug.<sup>7</sup> A description of the chemical composition and the properties of this compound may be found in a previous article by me.<sup>8</sup> Sixteen cases were then reported; the results were very favorable, and marked tolerance of the drug was noted. There was no evidence of renal or gastrointestinal irritation, frequently observed with intravenous mercurial dye therapy. The present paper contains a report on further cases of intravenous treatment with metaphen of bacterial infections of the blood stream of various types.

The drug was also used successfully by the intravenous route, by Spotts,<sup>9</sup> Fisher,<sup>10</sup> DuBois,<sup>11</sup> Bledsoe.<sup>12</sup> More recently Keeler<sup>13</sup> reports an interesting case of septicemia due to *Staphylococcus aureus*, in which metaphen was given intravenously with most gratifying results. Hirschfelder and Wright<sup>14</sup> in their study on the colloid chemistry of antisepsis and chemotherapy, report that metaphen shows no evidence of any colloidal particles under the ultramicroscope, and this observation is further confirmed by the fact that the preparation dialyzes completely and rapidly. It does not produce any noticeable changes in the ultramicroscopic appearance either of egg albumen or plasma, and it seems, therefore, that metaphen should show but slight tendency to produce anaphylactoid reactions upon intravenous injection. Levinson and Perlstein<sup>15</sup> studied the effects of intrathecal administration of mercurochrome-220 soluble and of metaphen, and arrived at the following conclusions: "Metaphen deserves further investigation as an intrathecal disinfectant, for not only does it have a larger margin of safety than mercurochrome, but it is bactericidal in sublethal doses."

In dealing with blood stream infections, it is of great importance to formulate a definite procedure with respect to the taking of blood cultures, and to adhere to it strictly in all cases, so that a systematic study may be made of the growth and habits of the invading organism. In my opinion blood cultures should be taken as soon as the initial chill and the sudden and marked rise in temperature occur, and one should not wait until bacteremia has existed for several days. The cultures should be repeated, if at first negative, for often a positive result is obtained only after repeated attempts. Care should also be taken that cultures are not reported negative too soon, and then discarded. It has been my experience that if cultures are allowed to incubate for several days the number of positive cultures is increased. Some observers have recommended an injection of adrenalin before taking a culture. This procedure is believed to increase the number of positive findings; however, at present I am not prepared to venture an opinion on this point.

It is a matter of prime importance to institute treatment at the first suspicion of septicemia, without waiting for the results of the culture. If the condition should turn out to be something else, it is unlikely that the patient will have suffered from the treatment, while if the suspicion of septicemia is confirmed, promptness in instituting treatment may turn out to be the decisive factor in saving the patient.

The method of treatment, described below, has been followed on all patients with very few modifications. As soon as the diagnosis is made, or whenever a suspicion of septicemia arises, an initial intravenous injection of metaphen 1:1,000 is given. The usual dose is 10 c.c. for the average adult; smaller doses are given to children and very old persons. It is not unusual to give an initial dose of 20 c.c. and even with this dose reactions are infrequent. In our previous paper certain points in connection with the administration of the intravenous injections of metaphen were mentioned which it is well to bear in mind (the use of a small gauge needle and the slow injection of the drug). The injections may be safely repeated every other day, for some of our patients have received injections daily without any untoward effects (as e.g., renal irritation, jaundice or gastrointestinal irritability). As has been mentioned before, should it turn out that the patient has not true septicemia, no harm will have been done; in fact, the drug seems to act prophylactically in such cases. At the same time, it should always be borne in mind that in cases of septicemia the sooner treatment is instituted the greater are the chances for recovery.

In addition to this treatment we have also used glucose 25 per cent, 120 c.c. daily; ingestion of alcohol is of considerable value. Other drugs, such as digitalis and strychnine were used whenever needed. Plenty of fresh air and sunshine are necessary, and attention to oral hygiene is of paramount importance.

In our series of cases we have found whole blood transfusions of considerable value. From 100 to 250 c.c. of blood were given every other day, obtained if possible from a different donor each time; the transfusion is performed when the patient's temperature is at the lowest level. The transfusions should be performed without moving the patient from his room and his bed.

In summing up our treatment of septicemia, we may emphasize the following factors: Most cases of septicemia follow surgical procedures, an abortion or childbirth, an acute or chronic sinus infection, or an infection of the same sort in the male genitals or female pelvis; a sore throat, otitis media, or an apparently trivial superficial external wound; in a minority of cases the original focus cannot be determined. What organic involvements are to supervene cannot be predicted in the beginning; endocarditis, suppurative arthritis, and embolic phenomena

are frequent. Some patients die very quickly from an overwhelming toxemia, others may linger only to succumb after several weeks or even months. The mortality has been placed as high as 60 to 80 per cent, according to Tileston,<sup>16</sup> and 70 to 90 per cent, according to Herriek.<sup>17</sup> Beckman<sup>18</sup> states that "when the prognosis is considered in a given case the following factors have to be seriously evaluated: (1) Variety of the organism, (2) volume of the organism, (3) virulence of the organism, and last but of considerable importance is the vital resistance of the patient."

We now present several typical cases to illustrate the results obtained:

CASE 1.—F. L., aged thirty-six, widow, onset, one week previous to admission to the hospital, with symptoms of an upper respiratory infection (fever, coryza, and cough).

Three days later (Dec. 4, 1931), the patient had a severe chill, and a severe lancinating pain developed in the right lower quadrant, pointing to the region of the bladder. On examination, the tongue was furred, the teeth were in good condition, the pharynx was slightly injected. The nasal mucous membrane was engorged.

Chest examination: The breath sounds were harsh, and an occasional crackling râle was heard at the right base, posteriorly, but no dullness was elicited.

On examination the heart was found to be normal.

Abdominal examination: On palpation, extreme rigidity was found in the right flank and right lower quadrant, the area of rigidity being extremely tender. Strangely enough, at no time was there any urinary disturbance.

Blood count on Dec. 5, 1931, showed the following: Hemoglobin 50 per cent; red blood cells 3,450,000; white blood cells 10,900. The urine was acid in reaction and showed a trace of albumin; there was a large amount of pus.

The temperature was 103° F., pulse 110, respiration 26. On Dec. 8, 1931, pyelographic studies were made and the diagnosis of stone in the right ureter was made. The location was given as about 8 cm. along the right ureterovesical orifice. The urine was cultured and a pure culture of *B. coli communis* was obtained. The patient's temperature, in spite of various forms of medication, ranged from 98° and 99° F. to 104° and 106° F. The pulse and respiration were correspondingly accelerated. The patient was having repeated chills and was rapidly losing ground. A blood culture was taken and on Dec. 14, 1931, a pure culture of *B. coli communis* was obtained. The patient was running a septic temperature from Dec. 4, 1931.

Finally, I was consulted and advised metaphen 1:1,000 intravenously. There were 10 c.c. given on Dec. 19, 1931. There was no reaction, and 10 c.c. were given on Dec. 21, 1931; on Dec. 22, 1931, the temperature reached normal and continued normal until the patient's discharge from the hospital on Jan. 8, 1932. Another culture which was taken on Dec. 30, 1931, was reported negative after several days of incubation.

The patient's physician informed us almost two and one-half months later that she was enjoying good health and did not have any recurrence of her former symptoms.

CASE 2.—Patient S., aged forty-seven, was admitted to the hospital on June 11, 1931. Diagnosis on admission was otitis media, arthritis, and septicemia. A blood culture was taken on the eleventh. On the thirteenth of the same month, a growth

of streptococcus was obtained, which, on the fifteenth, was shown to be *Streptococcus hemolyticus*. On the sixteenth, the blood was still positive for *Streptococcus hemolyticus*, and remained so until the twenty-sixth of June. Then it became negative and remained negative.

The blood count on the twelfth of June was as follows: Hemoglobin 87 per cent; red blood cells 4,400,000; white blood cells 18,000; polymorphonuclear cells 78 per cent; lymphocytes 22 per cent. On June 18, hemoglobin 75 per cent; red blood cells 4,000,000; white blood cells 13,400; polymorphonuclear cells 89 per cent; lymphocytes 11 per cent. On the twenty-fourth, hemoglobin 69 per cent; red blood cells 3,000,000; white blood cells 19,000; polymorphonuclear cells 88 per cent; lymphocytes 12 per cent. On July 15, hemoglobin 70 per cent; red blood cells 3,000,000; white blood cells 16,800; polymorphonuclear cells 71 per cent; lymphocytes 11 per cent.

The temperature was high for several weeks and of a hectic type. The patient had a suppurative arthritis of his knee which was incised and drained. During his illness, the patient received six injections of metaphen intravenously, of 10 c.c. each. The patient made an uneventful recovery. Ankylosis of the knee developed which, it is hoped, will be only temporary.

CASE 3.—N. D., aged thirty-two, female, white, four children living and well, admitted to the hospital on Feb. 13, 1931. Chief complaint, pain in lower abdomen and chills; somewhat nauseated. Last menstrual period, Dec. 8, 1930; amenorrhea during January and February. Examination revealed systolic murmur at apex transmitted to anterior axillary border. Temperature was 102° F., pulse 120, blood pressure 88/60. The blood count was as follows: Hemoglobin 60 per cent; red blood cells 3,307,000; white blood cells 7,200; polymorphonuclear cells 76 per cent; lymphocytes 24 per cent. There was moderate abdominal distention, and the spleen was markedly enlarged. Pelvic examination revealed a pregnancy of third month. There was no uterine bleeding. On February 14, a three-month fetus was expelled, but part of the placenta was retained. Patient had a chill, temperature rising to 104° F., and pulse reached 145. On February 18, some blood clots were passed and part of the placenta. The blood culture was positive for *Streptococcus hemolyticus*.

On February 19, the patient was given 10 c.c. of metaphen 1:1,000 intravenously; no untoward reaction. On February 23, she received 250 c.c. whole blood transfusion, and on the twenty-sixth, the temperature reached 106° F. Ten cubic centimeters of metaphen were given intravenously, also on February 27, and 1 c.c. of the patient's vaccine, containing a half million organisms in each cubic centimeter, was given to the patient. On March 2, the patient was feeling much better. On March 12, culture was negative, the patient was up and about and she was gaining weight. Spleen was no longer palpable. She was discharged in good condition on March 30.

CASE 4.—R. D., female, aged thirty-one, was admitted to the hospital on April 16, 1931. Last period, March 6; she missed the April period. The patient personally inserted a stick of slippery elm into the cervix and up into the uterus. Bleeding soon followed, accompanied by uterine contractions and pain. There was also elevation of temperature. On admission, the patient's temperature was 105° F., pulse 135, respiration 30; the blood chemistry was 98, and the blood count was as follows: red blood cells 3,500,000; white blood cells 21,100; polymorphonuclear cells 89 per cent; lymphocytes 10 per cent; 1 transitional; achromia. She complained of considerable pain, appeared quite ill, and was irrational at times. The sp. gr. of the urine was 1.010; there was a trace of albumin and the urine was nega-



tive for sugar. Microscopic examination revealed a few leucocytes and also epithelial cells.

Ten cubic centimeters of metaphen 1:1,000 were given intravenously. The temperature dropped to 100° the following day. Two days later the temperature reached 99°, then became normal. The patient was discharged in good condition.

The urine after the injection of metaphen was as follows: Sp. Gr. 1.009, no albumin. Microscopic examination was negative. The Wassermann was negative.

CASE 5.—O. B., aged forty-seven, female, admitted to the hospital March 27, 1931. Chief complaint on admission to the hospital—for the past three months, dysuria and pain in lower abdomen. Pelvic examination: cervix firm and pushed to the right, profuse white discharge coming from the external os. The uterus seemed fixed and there was a hard mass about the size of an orange; it was felt anterior to the uterus which was tender on palpation. The diagnosis was fibroid uterus. Studies on admission: Wassermann negative, urine acid 1.021, few epithelial cells. The blood count was as follows: red blood cells 4,910,000; leucocytes 5,100; hemoglobin 80 per cent; polymorphonuclear cells 42 per cent; lymphocytes 40 per cent; eosinophils 2; and transitional 18.

Operation, March 31, 1931, was vaginal hysterectomy and left salpingoophorectomy. The patient stood the operation well and seemed in good condition when returned from the operating room. That afternoon, the temperature suddenly rose to 105.4° F., pulse became very weak and rapid, the patient having chills and fever and temperature ranged between 103° and 105° F. The patient received 50 per cent of glucose intravenously, and seemed improved, but the temperature still fluctuated as before.

On April 12, 10 c.c. of metaphen 1:1,000 were given intravenously. The temperature now ranged between 98.8° and 100.4°. The patient was feeling well until the fifteenth, when she had another chill and the temperature went to 104°. Ten cubic centimeters of metaphen 1:1,000 were given again, intravenously. On April 23, the patient received 10 c.c. of metaphen intravenously, although she felt much better and the temperature was coming down. On April 25, 1931, the patient was given 375 c.c. of blood intravenously, mostly for the anemia. She had a slight reaction, after which the temperature came down to normal and continued so. The wound healed and the patient was discharged in good condition.

Blood culture: *Staphylococcus aureus*.

CASE 6.—G. C., aged twenty-seven, white, female. When first seen at patient's home, chief complaint—chills, fever, pain in right loin and lower abdomen, nausea and vomiting, associated with dysuria. This patient gave birth to a living child spontaneously four months previously. The puerperium not complicated and the convalescence uneventful. The onset of present illness sudden, with the above symptoms.

On examination, the patient's temperature was found to be 104.4° F., pulse 145, respiration 24. The white blood count 24,000; polymorphonuclear cells 90 per cent. The urine showed many pus cells; if specimen was permitted to remain in liter jar, about one-half was pus. The temperature ranged for ten days between 105° F. and 102° F. The patient had drenching sweat, and the prognosis did not appear to be good. Various urinary antiseptics and the usual treatment for pyelitis were tried without any improvement.

As a last resort, 10 c.c. of metaphen 1:1,000 were administered intravenously; at this time, the temperature was 104° F. There was no reaction following the injection. The following morning the temperature was found to be 101°. The next day 10 c.c. of metaphen 1:1,000 were again administered by the intravenous route. The temperature dropped to 100° F., then to normal, and continued so

without a rise. The patient was subsequently observed for several months; there was no recurrence and the patient is in good condition at the present time.

When the patient was last observed, which was about one year following the illness, the following studies were made: X-ray of kidneys, kidney function test and urinalysis, and white blood studies including blood count. Nothing abnormal was observed.

CASE 7.—A. T., female, admitted to the hospital on April 11, 1931. She was delivered of a macerated fetus on April 8. On admission the patient complained of severe lower abdominal pain and was bleeding profusely. Temperature was 102°; respiration 30; pulse 120; urine, acid, sp. gr. 1.020, trace of albumin, very many leucocytes. On examination, the fundus was felt at that time two inches above the symphysis pubis; very tender, and marked rigidity in left lower quadrant. The Wassermann was negative, the blood chemistry as follows: sugar 78; blood urea 10; red blood cells 2,900,000; leucocytes 7,400; polymorphonuclear leucocytes 67 per cent; lymphocytes 25 per cent; eosinophils 6 per cent; transitional 2; and achromia.

On April 16, 1931, 10 c.c. of metaphen 1:1,000 were given intravenously. On the twenty-third, 10 c.c. were again administered intravenously, the temperature ranging between 98° and 99.4°, and the patient improving. On May 11, 10 c.c. of metaphen were again given intravenously; temperature normal and patient feeling very well. Patient signed release on the twelfth, going home. Follow-up showed that this patient had no recurrence of symptoms and was feeling very well.

CASE 8.—E. W., female, admitted to the hospital March 31, 1931. Diagnosis: pregnancy at term, patient in labor, right occiput posterior; head rotated manually, forceps applied. Head delivered after median episiotomy. She was delivered April 1, 1931. On April 4, it was noted that the patient had a thick dark red vaginal discharge with a slight odor. On April 5, 1931, the patient had chills, face flushed, seemed listless and drowsy, temperature 104°, pulse 120. The blood count on April 5, 1931, was as follows: red blood cells 4,420,000; leucocytes 15,200; hemoglobin 70 per cent; polymorphonuclear leucocytes 84 per cent; lymphocytes 12 per cent; transitional 3. Patient complained on April 7 of abdominal distress, the abdomen being somewhat distended.

On April 13, 10 c.c. of metaphen 1:1,000 were given intravenously; patient feeling somewhat better, general condition fair. On April 20, 1931, the temperature somewhat elevated, patient seemed somewhat drowsy; slight abdominal pain. On April 21, 10 c.c. of metaphen were given, and also on the twenty-third. The patient felt better and the temperature reached normal. General condition good; she seemed to be improving steadily. On May 3, 1931, no complaints, temperature normal, and on May 5, 1931, the patient was discharged in good condition.

CASE 9.—P. C., female, was operated upon several weeks previous to admission, for gall bladder disease, a cholecystectomy having been performed. She was admitted on April 15, still complaining of severe pain in back and lower abdomen, associated with nausea and vomiting; also chills and fever. Patient was pregnant about five and one-half months, and had marked tenderness over costovertebral angle. On admission, the blood count was as follows: red blood cells 2,160,000; leucocytes 7,500, polymorphonuclear leucocytes 88 per cent; lymphocytes 9 per cent; eosinophils 1 per cent; and transitional 2. The urine was straw color, acid in reaction, sp. gr. 1.010. There was a cloud of albumin, and there were very many pus cells. The blood sugar was 102 and the blood urea 11. The patient was admitted on a stretcher with a temperature of 104° F.

She was given 150 c.c. of 50 per cent glucose, after which she vomited and complained of severe pain and having chills. She received her first injection of

metaphen 10 c.c. intravenously on May 7, 1931. The vomiting stopped, patient still nauseated, temperature 101°. On May 11, 1931, 10 c.c. of metaphen were given again intravenously. Patient still complained as before. On May 13, 1931, patient was again given 10 c.c. of metaphen intravenously, the temperature reaching normal on this date. On the fourteenth, 10 c.c. were again given, patient felt very much better, and seemed more cheerful. Urine at this time was amber, acid in reaction, sp. gr. 1.022; there was a trace of albumin, few epithelial cells, and many leucocytes. On May 19, 1931, the patient was up in a wheel chair, temperature, pulse, and respiration were normal. On May 20, 1931, patient was discharged in good condition with normal temperature and without any complaints. Follow-up showed no recurrences.

CASE 10.—R. S., female, aged twenty-one, admitted to the hospital Nov. 5, 1928; evidence of criminal abortion at the sixth week of pregnancy. Complaint on admission—marked abdominal distention and rigidity. Patient's temperature was 104° F.; pulse 140; respiration 30; the blood count as follows: red blood cells 5,200,000; leucocytes 22,700; hemoglobin 80 per cent; polymorphonuclear leucocytes 92 per cent; lymphocytes 7 per cent; transitional leucocytes 1.

Ten cubic centimeters of metaphen 1:1,000 were given intravenously; temperature down to 100.8°; pulse 120; respiration 25; blood count: leucocytes 19,950; polymorphonuclear cells 93 per cent; lymphocytes 7 per cent. Patient felt somewhat better. On Nov. 7, 1928, 10 c.c. of metaphen were again given intravenously, temperature reaching normal, pulse 90; blood count now was: leucocytes 10,750; polymorphonuclear leucocytes 79 per cent; lymphocytes 21 per cent. Patient improved and was discharged in good condition on Nov. 17, 1928, the temperature being perfectly normal.

In addition to the metaphen therapy, the patient also received digitalis and operative treatment. It will be interesting to note that this patient returned several months later to my office still pregnant and was subsequently delivered of a normal healthy child.

CASE 11.—G. S., female, admitted to the hospital April 6, 1931, and was delivered that evening. Diagnosis was right occipitus posterior; manually rotated and forceps delivery. Patient was delivered without lacerations. The temperature continued practically normal until one week later, when it reached 103° F., pulse going to 102 and respiration to 25. On April 15, the temperature reached 105°. The lochia was very foul. On examination, the fundus uteri was found to be midway between the symphysis pubis and the umbilicus. There was also tenderness on both sides of the uterus, more marked on the right. The heart and lungs were normal. Urine examination essentially negative.

Ten cubic centimeters of metaphen were given intravenously; temperature dropped to 103° F. and finally to 100°, but the following day it again reached 103° and finally 104°. Ten cubic centimeters of metaphen were again given intravenously and the temperature gradually dropped, reaching 99° on the eighteenth and normal on the twenty-fourth. On the twenty-sixth of April, patient feeling well, no tenderness, very much improved. Patient was discharged on April 28 in good condition.

#### DISCUSSION

Case 1 represents a case of renal calculus and *B. coli communis* bacteremia; the patient was extremely ill, and various forms of medication were tried, the patient being ill for fifteen days before metaphen was given intravenously; after two injections, the temperature reached

normal without any reaction and remained normal, the patient recovering completely.

Case 2 represents a case of *Streptococcus hemolyticus* septicemia, probably secondary to an infectious arthritis of the knee joint. Positive blood cultures were obtained repeatedly from June 13 until June 26, when the culture was reported negative and remained so until the patient's discharge from the hospital. During this patient's illness, he received six injections, 10 c.c. each, of metaphen 1:1,000 intravenously; there were no reactions or evidence of gastrointestinal or renal irritation. The patient made a good recovery except for an ankylosed knee as a result of the infectious arthritis.

Case 3 represents a case of *Streptococcus hemolyticus* septicemia following an incomplete abortion, complicated by splenic infarct. This patient was extremely ill, her temperature reaching 105° F., and at times her pulse was so rapid that it was impossible to count it. She received two injections of metaphen 1:1,000, 10 c.c.; the temperature became normal. The patient's spleen was no longer palpable, and she began to gain weight when she was discharged from the hospital.

Case 4 represents a case of criminal abortion. The patient was admitted to the hospital eight days after the induction. On admission, the temperature was 105° F., the pulse 135, the respiration 30, and the patient was delirious. Ten cubic centimeters of metaphen 1:1,000 were given intravenously and the temperature reached 100° F. the following day. Two days later, another injection of 10 c.c. of metaphen was given, and five days after the first administration the patient left the hospital in good condition.

Case 5 represents a case of *Staphylococcus* septicemia following supravaginal hysterectomy and left salpingo-oophorectomy. The patient was extremely ill, the temperature reaching 105° F., accompanied by daily chills, then dropping to subnormal. The patient received three injections of metaphen 10 c.c., 1:1,000 intravenously. She was discharged six weeks following the operation in good condition with the wound healed and no complaints.

Case 6. Acute pyelitis, the urine was loaded with pus, the temperature reaching 105° F., white cell count 24,000 with 90 per cent polymorphonuclear cells. The pulse and respiration were correspondingly accelerated. Various forms of therapy were tried; finally, an intravenous injection of 10 c.c. of metaphen 1:1,000 was given; the temperature dropped promptly from 105° F. to 101° F. without reactions. Two days later, 10 c.c. of metaphen was again administered by the intravenous route, the temperature reaching normal and remaining so; the patient made a complete recovery.

## SUMMARY

The following factors concerning septicemia and its treatment appear to deserve especial emphasis:

1. In the usual conception of septicemia, attention is focused on the organism in the circulating fluids of the body to the exclusion of all other factors, while in reality, septicemia is a recognized clinical entity, of which the presence of invading organisms at some time in the blood stream is only one feature.

2. It is well to bear in mind the fact that septicemia is by no means of rare occurrence, as the statistics quoted at the beginning of this article testify, and that the problem, therefore, requires the serious consideration of the medical profession.

3. It is important that cases of septicemia should be studied both clinically and in cooperation with the laboratory.

4. Septic cases demand early diagnosis, isolation, and proper treatment.

5. Hospitals should have special sections for septic cases, in which ideal conditions and adequate treatment may be provided.

6. Research on the prophylaxis, causes, and treatment of septicemia by the medical schools, with cooperation of various departments, is necessary for advances in this field.

7. It is my opinion that at the present time there is no bactericidal agent which can be safely introduced into the blood stream in quantities sufficient to sterilize it completely. However, we have found that metaphen 1:1,000 when introduced into the blood stream exercised a marked bacteriostatic effect on the invading organisms; if the resistance of the individual could be reinforced at the same time, our results would be most gratifying.

## CONCLUSIONS

In our study stretching over a period of several years, many cases of various blood stream infections have been studied and closely observed, metaphen 1:1,000 having been used intravenously. Our results in the majority of cases have been remarkably gratifying, and in no cases have we found evidence of toxic effect or untoward reactions due to the treatment with this drug. On the basis of these observations, we have come to the conclusion that metaphen when introduced into the blood stream of individuals suffering from septicemia, acts as a bacteriostatic rather than a bactericidal substance. We believe that this property alone is responsible for the conspicuous absence of reactions; at the same time, the disease is treated along natural lines, since the individual's own resistance is permitted to play the prominent part which it should play in combating all infections.

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2007 PINE STREET.

## REPORT OF A CASE OF ABLATIO PLACENTAE FOLLOWED BY SLOUGHING OF THE UTERUS\*

W. A. COVENTRY, M.D., AND RUSSELL J. MOE, M.D., DULUTH, MINN.

(From the Duluth Clinic)

**M**RS. S. P., thirty years of age, para i. Seen on March 12, 1932 at which time she gave the following history:

She had had one previous pregnancy accompanied by premature birth with death of the fetus, cause unknown. The last menstrual period was Sept. 29, 1931. Apparently she was going through a normal pregnancy, having been under the care of a physician who stated that at no time was there any evidence of toxemia. On March 8, 1932 she was markedly shocked and frightened on the occasion of an explosion of a furnace in her home. At the time of the explosion she suddenly jumped out of bed, landing on her feet, but felt that she had jarred her body considerably. At that time she had some pelvic and abdominal pain which after a few hours disappeared and she says that she felt fairly well for the next two days. She again consulted her physician because of the fact that she felt weak, faint, and became very pale. Her condition was alarming enough to have her removed to a small private hospital where during the next two days she suffered severe abdominal cramps which were constant in character and she remained extremely pale and weak. Vaginal examinations were made, but no therapy except bed rest and relief of pain. At this time she came under our observation.

The patient looked extremely ill, the conjunctiva and lips were almost a waxy white. Temperature 99°. Hemoglobin 35 per cent with 1,500,000 red blood cells. Urinalysis was negative. Blood pressure 110/60. The abdomen was markedly distended with the skin shiny. The uterus appeared to fill the entire abdominal cavity. The abdomen was so hard and firm and so extremely tender that it was impossible to outline the uterus. The heart tones could not be heard and there was no placental souffle. There was no bleeding from the vagina.

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A diagnosis of ablatio placentae was made and the patient was immediately prepared for cesarean section, which was performed under spinal anesthesia. Anticipating the necessity for transfusion, donors were obtained. Upon opening the abdomen the uterus was found to be very markedly distended, very thin, very tense, and dark blue in color. The muscle fibers of the uterus seemed to be "teased" apart—necrobiosis. A large amount of blood and clots was found between the membranes and the inner wall of the uterus. The fluid was aspirated, the membranes opened and the dead fetus delivered. Also the placenta delivered without any incident. Pituitrin was immediately given, but the musculature of the uterus was so flabby and had lost its tone to such a degree that the pituitrin had no effect upon contraction. The wound was closed in the usual manner and intravenous glucose and saline resorted to at once. Hysterectomy was not performed because the patient was too ill, and we thought it poor judgment to subject the patient to further surgery.

During the first week postoperatively the patient's convalescence was exceedingly stormy. There was a great deal of ileus with accompanying distention. At no time was there any sign of obstruction. After a week the bowels began to move and the distention disappeared. Then we were able to outline the uterus above the level of the navel. No involution had taken place, in fact the uterus was larger than one would expect at this time postpartum. It was our opinion that the patient was bleeding into her own uterus. During this time five blood transfusions were given with good response.

On the tenth day postoperatively the sutures were removed and the wound was probed with the result that there was a discharge of considerable amount of gas through the probed wound. Our first impression was that there might have been a perforation of the intestine. The release of this gas gave the patient a great deal of relief. Accompanying the gas there was considerable old, blood-stained fluid. The edges of the wound finally separated and we were able for several days to remove daily nearly a quart of blood-stained fluid. Profuse drainage continued for ten days. At no time was there any evidence of fecal material. Slough now appeared in the wound and at first we thought this was due to necrosis of the abdominal fat or the omentum, but on further examination it was found that the uterus itself was sloughing out of the abdominal wound. When more slough appeared and more was cut away, it became apparent that the omentum had formed a wall above the uterus, walling off the small intestine and that the uterus itself was sloughing through the abdominal wound. The patient was showing no evidence of peritonitis; the bowels were moving regularly; and the appetite was good.

Phlebitis appeared on the twenty-second day accompanied by the usual rise in temperature and pulse. This phlebitis was in both limbs. The condition was given appropriate treatment. Eventually the wound healed by secondary intention and at the end of four months the patient was discharged from treatment. However, before discharge attempts were made to inject the uterus with lipiodol, and we found that the uterus except for the cervix had entirely sloughed out through the abdominal wound.

In our review of the literature we have been unable to find any case report of sloughing of the uterus through the abdominal wound following this condition, and we attribute the cause of this entirely to the fact of the marked necrobiosis of the uterus, cutting off the blood supply to the muscle itself.

# CONGENITAL DEFECTS OF THE SCALP

## STUDIES IN THE PATHOLOGY OF DEVELOPMENT, III

N. WILLIAM INGALLS, M.D., CLEVELAND, OHIO

*(From the Anatomical Laboratory, Western Reserve University)*

MINOR aberrations and disturbances in what may be called the typical or normal characters of the skin, particularly as regards pigment, hair, glands and vascular supply, are so common that they constitute the rule rather than the exception. This is not surprising in view of the relatively large expanse of cutaneous surface and the peculiar qualities and capacities inherent here; a sensitive, adaptive and at the same time a protective body covering of remarkable efficiency. One can hardly expect anything approaching uniformity, much less perfection, over an area of from 18 to 20,000 sq. cm., some 20 sq. ft.; especially in a structure, like the skin, where slighter or even more marked deviations from the normal are, as a rule, of little or no practical significance. In marked contrast with this extreme, even commonplace variability of the skin for minor details, is the relatively rare occurrence of actual defects, however small.

The extreme rarity of cutaneous defects, in comparison with the possibilities for other types of maldevelopment here, can only mean that the natural, inherent factors at work in covering the body with some kind of an epithelial layer, are far more ancient, more deep-seated and fundamental, more tenacious and stubborn, than those influences which prescribe the finer details of that covering layer once it has been established. Or, in other words, relatively feeble or late-acting developmental, or other factors may suffice to bring about variations in skin details; but in the case of frank defects, absence of skin, one must invoke some far more powerful and more incisive genetic influences, or take refuge, for etiologic purposes, in actual trauma, physical violence or some other external form of tissue destruction.

Not only are cutaneous defects very infrequent, but they are of particular interest because they are most commonly located on the scalp and moreover, as a rule, on the vertex, in or near the median line. It is with this manifest predilection of a rare cutaneous condition for a definite part of the body that we are primarily concerned at this time.

As late as 1910 Kehrer noted only 32 cases of scalp defects in the literature, adding one of his own. In 1924 Heidler could find but 42 cases and in 1930 Terruhn cites 76 cases of scalp defects and 29 cases of skin defects elsewhere on the body. Doubtless, as Heidler suggests, there may be many cases which have not found their way into the literature since the slighter defects may be quite inconspicuous and of



little practical importance. We have made no attempt whatever to exhaust the literature on scalp defects, but such references as we shall make are based on some 60 cases. As the most important literary sources we may note Kehrer 1910, Bettmann 1912, Walz 1924, Lundwall 1927, Terruhn 1930 and Greig 1931, few other specific citations will be made.

Briefly, the more important features of these 60 cases, more or less satisfactory as to the data recorded, may be noted as follows:

In more than half the cases, the defects are in the mid-line, often noted as "exactly" in this position, and in over 80 per cent they are in or near this location. They are most commonly found near the vertex, "am Scheitel"; as a rule somewhere along the sagittal suture or in the region of the fontanelles, more frequently over or near the posterior than the anterior fontanelle. Exceptionally they may occur more laterally, over the parietal, in the neighborhood of the ear, or on the forehead. In some 70 per cent of cases the defect is single and in about 20 per cent double; in a little over 8 per cent there were 3 defects, while in one case, 1+ per cent, 4 were noted. In this respect cutaneous scalp defects differ, and significantly, we think, from skin defects elsewhere which are almost, if not invariably multiple. Where more than one scalp defect is present, there is a well-marked tendency, more than a third of cases, toward a symmetrical arrangement and a similar tendency is often noted in defects on the trunk or limbs.

As regards the gross features of scalp defects there is considerable variation, due, no doubt, to the extent or degree of the original damage and the varying amount or success in the subsequent healing. The only common character in all of these cases would appear to be the absence of hair, and it may very well be that certain of those cases described as congenital alopecia, not to mention other conditions, really belong in this category and share in the same etiologic background. As a rule the defects are not large, from 1 to 2 cm. in diameter, but they may be much smaller, less frequently larger, and only rarely of the huge dimensions occasionally noted, up to 50 sq. cm. Not infrequently, particularly in regards to the smaller defects, the form may be quite regular with sharp margins, the whole often being described as punched out in appearance. Some defects appear fresh, as if newly made, others show more or less complete, often irregular, cicatrization, while in many cases there is a well-defined, narrow, hairless or otherwise altered margin, separating the defect from the normal scalp. The surface may be smooth and dry, or more raw and moist, granulating, hemorrhagic, later even suppurating. In the majority of cases the defect involves only the epidermis and the subjacent cutis to a varying extent, but it may extend to the galea, or even beyond this to the pericranium and dura. It is particularly in these deep defects that the underlying or neighboring bone is defective, thin and parchment-like, or the sutures

and fontanelles may be unusually wide. In Ahlfeld's case, quoted from Kehrer, No. 22, there was a lock of hair of unusual length growing from the margin of the defect, a very suggestive finding.

In five cases, a little over 8 per cent, there were skin defects elsewhere on the body. Much more frequently, however, too often probably to be a mere coincidence, scalp defects are associated with some of the commoner malformations of other parts but in only a third of our cases is it noted specifically whether, except for the scalp condition, the child was normal or not. Most frequent among these associated anomalies are those affecting some part of the head; hydrocephalus meningocele, cheilo- and palatoshisis, coloboma, microphthalmos, in the limbs a variety of conditions have been observed.

Of special interest is the condition of the fetal membranes in these cases, because of the reputed rôle of the amnion in bringing about these, as well as other defective states. Unfortunately in most instances, particularly in the older records, there is no good evidence on this point, in the present series there is usable information in only 16 cases. In 11 of these the membranes are noted as normal, once there was hydramnios, twice oligohydramnios; but only three times, once in association with oligohydramnios, are amniotic bands or adhesions mentioned.

Among the cases where the sex is given females are in the majority, and this preponderance is still more accentuated in those cases of prematurity and early death. In a little over half the cases, where data are given, the affected child was the first, and some emphasis has been laid on the greater tendency in primiparas to oligohydramnios, lesser distensibility of the uterus and a more probable lack of room for the developing fetus. Anomalies of presentation also seem to be particularly common.

Not infrequently the family history provides information of great importance in the consideration of etiologic factors. One case was that of a fourth child, premature at seven months; the first child had died at seven weeks, and the third was an abortion at three months. In another the scalp defects occurred in a fifth child, the first three being premature, the fourth was a rachishisis. Sitzenfrey's case was also a fifth pregnancy; the first child died at four months, the second and third were both hydrocephalic, necessitating perforation, the fourth living at one and one-half years, showed a large head and open anterior fontanelle, while in the fifth there was oligohydramnios and a hydro-meningocele at the lesser fontanelle. This case is exceptional, if not unique, in that the skin defects were located on the meningocele. Even more suggestive are those cases where similar or possibly related anomalies occur in other members of the same family. As long ago as 1826, Campbell (Greig, 1931) reported an ulcer in the region of the posterior fontanelle in two children of the same mother; the first died

of hemorrhage, the second at eight months from hydrocephalus. Burger's case is very similar, two children showing similar defects, the first dying within a few days. In Greig's second case, besides the scalp defects, there were present complete harelip and cleft palate and polydactylism; the father had an incomplete harelip. Graff, in reporting what he terms aplasia cutis congenita, notes a combination of some of the conditions noted above. The scalp defect occurred in a fourth premature child, the preceding three pregnancies had terminated early, at seven and eight months, and in all three there was early death of the child. In this case the father presented, in exactly the same place, a small circular tonsure, and in the case of both father and child the midwife had been blamed.

As regards the etiologic factors at work in the production of skin defects both on the scalp and elsewhere, there is still some divergence of opinion. The older, amniotic origin of these, as well as many other types of malformation, was accepted by Kehrer, who first collected a large number of these cases, and who considered amniotic anomalies as the only possible explanation. As a result of inflammatory changes, of unknown origin, an amniitis, adhesions are formed between the amnion and embryo, either the solid bands of Ahlfeld or the hollow forms of Simonart. These in turn, by their traction of the developing skin, due in part to fetal movements, etc., may tear out pieces of integument, although later these offending bands may disintegrate and disappear entirely. This point of view is all the more remarkable since in the 33 cases noted by Kehrer the membranes are given as normal in a number of instances, but not once is there good evidence of the presence of adhesions. Indeed the condition of the membranes, amnion, is held to be of no diagnostic consequence.

Following Kehrer, and apparently inspired by him, Oing, 1929 but more especially Terruhn, hastened to the defense of the fading amniogenic theory. Neither of Oing's cases, however, showed amniotic adhesions, but following a diligent hour and a half search Terruhn was rewarded, in one of his two cases, with a solid amniotic band, 8 cm. in length, with fresh flesh-colored fragments and clotted blood on the free end. We are appraised, in italics, and there are many other italics in his article, that this is the first time that such conditions had ever been found.

Terruhn's long and imposing array of cases is anything but convincing however, and we cannot see that either his conclusions or his statistics are adequately supported by the evidence presented. Much has been written about a hypothetical amniitis and a close fitting amnion, both of which would seem to conspire to disturb proper growth and development. But the largely imaginary existence of these conditions, the acknowledged rarity of actual adhesions, the very frequent symmetry and peculiar characteristics and localization of the skin de-

fects in question, together with the obvious evidence of the participation of endogenous, hereditary factors in many cases, gradually lead to the conclusion that, as Heidler remarks, the amniogenic theory had been "gewaltig überschätzt." More and more the almost total lack of evidence pointing to *primary* amniotic influences became apparent, and here, as in most other malformations, the paramount importance of internal, inherent, often hereditary factors, rather than external physical conditions, was recognized as the *fons et origo mali*. As noted above there are a significant number of cases in which the family history indicates, in one way or another, the influence of endogenous factors, and statistically these cases far outweigh those showing possibly causative amniotic conditions. Not only in skin defects, so called, but in those more serious cases of what are known as intrauterine amputations, there is likewise evidence of internal, possibly also hereditary factors (Streeter, 1930).

Many, if not all congenital scalp defects, excepting naturally those of obviously traumatic origin, can be explained, we believe, on the basis of inherent developmental factors which impress upon the mid-line of the head a degree of sensitivity or vulnerability equalled perhaps nowhere else in the body. In a previous paper (1932, 1) we have discussed the character and source of normal developmental factors and their relation to maldevelopment, particularly in the dorsal region of the human body. Subsequently (1932, 2) we enlarged upon this theme, more from the standpoint of pathology and further illustrated our position by presenting a number of cases of early pathologic processes in human embryos. Briefly put, one may say that the dorsal mid-line of the vertebrate body, and more especially the human body, is characterized by a very definite instability and variability, due to the inherent capacities and potentialities, the peculiar and complex genetic constitution of the cells and tissues involved and of the relatively massive and extremely important rearrangements which must be effected here. The direct result of these unstable, even vulnerable conditions is seen, on the one hand, in the extreme frequency of major mid-line defects, anencephaly, rachischisis, etc., and on the other in those comparatively rare head or scalp defects which we are considering at present. These, as well as other anomalies, belong in one and the same category as suggested by Walz. They stand at either end of a long and complicated series; ranging all the way from gross, extensive defects, extending from the skin through the cavity of the nervous system, down to cutaneous anomalies so slight that they may be overlooked entirely. It is paradoxical perhaps, that the former should be so common, while many of the latter, scalp defects, are so rare. Not only is the mid-line particularly unstable and vulnerable during development, but there is often a well-marked predilection for the embryonic head, corresponding with the favorite site of scalp anomalies. We have noted a number

of instances of this in our second article (1932) and abundant evidence in the same direction is provided by the extensive works of Mall, 1908 and Mall and Meyer, 1921. Curiously enough, those gross mid-line defects which are so frequent at term, are not commonly seen during the early weeks of gestation, while the smaller superficial anomalies, from which we derive the rare scalp defects, are by no means unusual during this period. One must either conclude that many of the incipient stages undergo complete restoration, or their remains are always overlooked, or else the conditions in these cases, whether internal or external, are more serious or more lethal than the apparent extent or severity of the damage would lead one to suppose. In the former, the term cases, the derangements may be more in evidence in the fetus than in the adnexa, while in the latter the embryo escapes to a large extent, but its membranes and its nutritional sources are so altered or compromised that early death and abortion are the result.

In these early entaneous, or superficial alterations on the embryonic head, we have the first signs of those abnormal or even pathologic processes which may persist until term when they appear as scalp defects of varying extent and severity. In their initial stages, as later, they may exhibit a variety of characters. The area involved may be larger or smaller, the effects may be confined apparently to the covering epithelium or the underlying connective tissue, as well as deeper structures may share in the general process. Blebs or bullae may be formed just beneath the epithelium, or there may be accumulations of fluid at a deeper level. The epithelium may be, to all appearances, normal or it may be absent or torn away and frequently there are irregular and erratic epidermal thickenings bounding the defect. Both the superficial and deeper layers may be modified in a variety of ways, without it being possible to determine how severe the damage may be, how long the process may have been active or what the probable outcome would have been. In some cases it would seem as if complete restitution might have been possible, but it must be remembered that one is not dealing here with some hypothetical damage to healthy, normal tissues, but rather with structures which are inherently abnormal or tainted, and their unusual and in part unnatural bent to faulty development may very well mean also a diminished, ineffectual or otherwise perverted capacity to restore normal conditions. Judging from the final results, as seen at the end of pregnancy, this healing process varies greatly; but rarely if ever is normal skin produced, and very often there seems to have been only very feeble attempts at restoration. All of this would indicate that the damage done is very deep seated, affecting adversely the proper potentialities of the cells concerned, rather than any simple trauma to ordinary tissue. As regards this capacity for healing, there seems to be a well-marked difference in the behavior of these typical scalp defects and those encountered elsewhere on the

body. Although the latter are as a rule far more extensive, often multiple as well, they are much more often completely cicatrized, or apparently of less recent origin, and they do not present the sharp punched out, fresh appearance of the typical scalp lesion. These differences are, we think, the expression of the greater initial damage, the more profound alteration in the inherent capacities of the cells in the mid-line, more particularly on the scalp, and such disturbances probably date from an earlier embryonic stage and are therefore more effectual in disrupting or retarding development. Although many of these cases show little attempt at intrauterine healing, as a rule there is



Fig. 1.—Embryo No. 611, 23 mm. long. Small thin walled bleb over cerebellum. Farther forward in the mid-line there is a second deeper accumulation of fluid, not visible here.

relatively rapid healing after birth. It would seem as if continued immersion in amniotic fluid, which may not always be normal, was unfavorable and more so in the case of scalp conditions than in those located on other parts, or farther from the mid-line. In Höffel's case, cited by Lönne, 1921, there was a large defect on the back from which band-like extensions encircled the trunk. Of these more lateral bands, one was healed at birth and the other in two weeks, but the dorsal defect was not covered over for more than two months.

In none of our embryonic cases are there any amniotic adhesions or any indications that they were likely to form. It is altogether pos-

sible, of course, that connections might have been established later, over some of the raw spots and the connecting material might be embryonic instead of amniotic but in any case the primary trouble appears in the embryo rather than in the membranes. We have no inclination to deny the possibility that skin defects and adhesions may coexist, or that the latter may not even exert some influence upon the former but here, as elsewhere, their relation to the disturbed development is secondary and not primary. They are accidental features and not causal factors.



Fig. 2.



Fig. 3.

Fig. 2.—No. 597 B, 32.5 mm. smaller twin. Large bulla over vertex hands and cord malformed.

Fig. 3.—No 665, about 15 mm. Extensive symmetrical defect over anterior end of head, epithelium lacking. Face and head deformed, posterior end of body damaged.

But aside from the skin conditions exhibited by our series of embryos, there is additional evidence of a common etiologic background for both the early and late cases in the similarity of what we may call the family history, hereditary and external factors. Most of our embryonic cases are from the second month, when the bulk of abortions occur, the menstrual history varies greatly, often these had been earlier abortions, the chorion is frequently abnormal often the site of cystic changes, hydramnios is not infrequent while in many cases there are accom-

panying malformations in other parts of the body or the embryo may present a variety of pathologic rather than strictly teratologic conditions. For the later stages, from the literature, we have already noted the frequent miscarriages, prematurities, high fetal mortality and morbidity, and the presence of associated anomalies.

A more extended account of these embryonic conditions will be found in our earlier paper, and we shall call attention here only to a few cases.

Fig. 1 represents a 23 mm. embryo, No. 611, obtained from a hysterectomy for pelvic deformity, at ten weeks. In the mid-line over the cerebellum is a minute, thin walled bleb, and there are a few small scattered ecchymoses on the head and trunk. In the region of the bleb, only the epidermis is elevated, but farther forward, also in the midline there is a larger and deeper accumulation of fluid, not visible in the photograph.

No. 597 B, Fig. 2, is considerably older, 32.5 mm., the smaller of twins and the second abortion out of three pregnancies. Just behind the vertex is a very conspicuous, symmetrical bleb, 7 mm. in anteroposterior extent, the deeper structures are apparently not involved. The hands are malformed and the cord is badly kinked and twisted. Although in both of these cases the surface layer is still intact, it would have required but little to tear this thin distended membrane, as has happened in some of our cases, so producing an actual raw defect. The larger companion of No. 597 B is apparently normal in every way, and if pregnancy had continued, the smaller one might have appeared at term as a fetus papyraceus. We mention this because in a surprisingly large number of these cases showing cutaneous defects on trunk or limbs a fetus papyraceus was present (Lundwall), in Rüder's case there was also an extensive scalp lesion.

An actual loss of superficial epithelium is seen in No. 665, Fig. 3. The embryo is only 15 mm. in length and has suffered considerable postmortem damage. The defective area covers most of the anterior end of the head, it is remarkably symmetrical, of a brownish color and the bordering epithelium is irregularly thickened.

Embryo No. 167, Fig. 4, is of particular interest since it shows multiple anomalies on the head, all in or near the mid-line. On the back of the head there is a very striking, transversely disposed, symmetrical discolored area (cf. Ingalls, 2, 1932, Plate III, Fig. 10), in advance of this is a smaller spot and still farther forward high up on the forehead, Fig. 4, are two symmetrically placed dark spots, even more conspicuous than the posterior one. The epithelium is for the most part intact, but there are evidences of its giving way. Cutaneous defects have been noted in the frontal region in combination with similar conditions farther back, as in this instance.

In No. 442, Fig. 5, there is a very conspicuous, dark, sharply defined frontal band in much the same location as in the preceding case. This specimen was from a tubal pregnancy, following an earlier abortion; there was also an extensive defect in the sacral region behind. The covering epithelium seems to be intact, but there is some thickening along the margins of the area.

In concluding we would note briefly the conditions present in No. 536, Fig. 6. There had been four previous miscarriages and one birth at eight months before this specimen was aborted. Bad tonsils and infected teeth are noted in the history as well as the possibility of syphilis. Some writers have thought that infections in the mother might predispose to amniotic anomalies and adhesions and





Fig. 6.



Fig. 5.

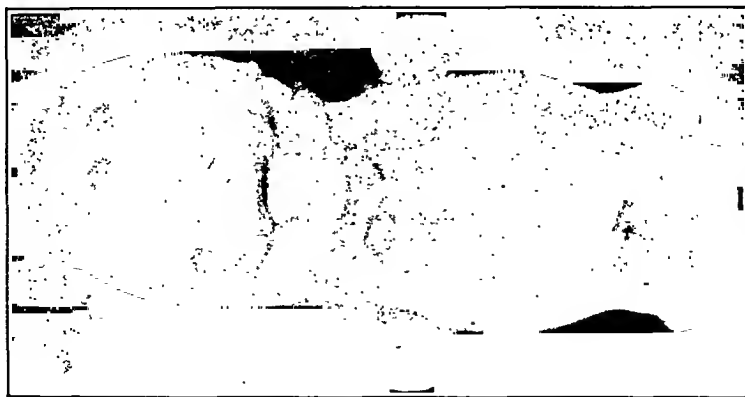


Fig. 4.

Fig. 4.—No. 167, 185 mm. Conspicuous altered skin areas on anterior part of head. There are two other similar spots in the mid-line farther back.

Fig. 5.—No. 442, 26 mm. Well-defined and symmetrical frontal band marked changes in the subepithelial tissues. There is also a defect in the sacral region behind.

Fig. 6.—No. 536, 17.5 mm. Large discolored patch in lower lumbar and sacral regions, similar areas over upper thorax. Many bizarre changes in skin.

syphilis has often been considered among the etiologic factors involved in scalp defects. The most conspicuous changes here are seen in the mid-line of the back low down and higher up in the region of the shoulders, and in both places there is a very obvious symmetry, a condition very frequently encountered in skin defects. In this case the skin is thickened, denser, and more scaly than usual and the subcutaneous tissue seems more fibrous than in normal embryos, as if it might represent an early stage of the extensive fibrous cicatrices seen at birth, sometimes described as keloid in appearance. In this particular embryo, as well as in others, we have encountered a number of bizarre histologic findings which would seem, in some cases at least, to represent a distinctly pathologic process engrafted upon teratologic conditions.

The interest and importance which attach to these congenital cutaneous defects, more especially those of the scalp, is evidenced by the increasing number of cases which have found their way into the recent literature, chiefly in German obstetric and gynecologic journals.

These scalp conditions, though relatively infrequent, have a special claim upon the attention of the obstetrician, since it is he, ordinarily, who would first become aware of their existence. Upon him would devolve the responsibility for appropriate treatment, and it would also doubtless fall to his lot to offer some more or less satisfactory explanation. We think that Heidler is quite right in believing that scalp defects are more common than is generally supposed, and that only the more striking or more serious cases have been placed on record. That, as a rule, only the major and more serious defects are to be found in the literature may be inferred from the mortality recorded. For the 60 odd cases which we have considered, the mortality, including stillborns, was about 20 per cent, with most of the deaths more or less directly referable to the lesions present on the scalp.

The fact that the majority of these cases go to term, naturally those which escape embryonic death or those in which the defect appears relatively late, and that these cases then show a sudden and significant increase in mortality, at or shortly after birth, would indicate that, from a practical standpoint, they may be looked upon as birth injuries. They are birth injuries, and also antenatal injuries or insults, of a peculiar character however, in that one may recognize *predisposing* as well as *exciting* causes.

The predisposing influences are ingrained in the embryonic constitution, they are essentially genetic, natural characters and they may therefore assume an hereditary aspect. The exciting, or aggravating and complicating factors are of greater practical importance since they are amenable, in some measure, to treatment and control. They are to be found in the environment of the embryo and fetus, in the more or less abnormal and unfavorable condition presented by the maternal organ-

ism, as witnessed by the uterine or menstrual disturbances, the number of abortions, often repeated, and the frequency and extent of abnormal changes in the membrane.

Up to the time of birth these scalp conditions seem to be of only minor significance, but following labor it is a very different story. There is little if any evidence, antepartum, of bleeding and still less of infection. After birth there is frequent and abundant evidence that the primary lesion has been more or less radically altered, and that for the worse. Hemorrhage is common, and the defect is often described as a *fresh* wound, which may even be infected. Indeed it is the apparent newness of the condition, and the obvious evidence of actual recent trauma which have more than once excited suspicion as to the possible rôle played by the medical attendant or midwife. The fact that these defects show only feeble or imperfect attempts at intrauterine healing renders them all the more liable to damage and complication during or subsequent to labor. There can be no doubt that many of the abnormal conditions which we have encountered in early embryos, where the developmental disturbance has been very slight and where the skin or epidermis is still intact, would have suffered very severely during labor, if these same conditions had been present at that time. This applies especially to the slighter, more superficial defects, bullae, etc., which could hardly have escaped rupture or more extensive laceration. Except for predisposing factors these would be typical birth injuries, there would have been actual damage and destruction of tissue; postpartum and antepartum conditions would have been quite different.

The peculiar character and significance of scalp defects are seen by contrasting them with cutaneous defects elsewhere. Although relatively infrequent, either alone or in association with scalp lesions, skin defects on the body or limbs are usually multiple and often very extensive. In spite of this, however, they are of much less practical importance and they appear to suffer little or not at all during labor. Although they may be very large, they are superficial rather than deep, they heal much more readily than scalp defects, often before birth, and they do not show the secondary complications of hemorrhage or infection and the consequent effect upon mortality; their significance is largely cosmetic.

Scalp defects belong in another category, they have quite a different etiologic background, while the quality and integrity of the tissues have been much more profoundly altered. Their important topographic relations, the relative ease of injury and the feeble reparative capacities with which they seem to be endowed, all conspire to create conditions, the gravity of which is often still further increased by the trials incident to or following labor.

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## HYSTEROSTOMATOMY\*

LAWRENCE M. RANDALL, M.D., ROCHESTER, MINN.

(From the Section on Obstetrics, The Mayo Clinic)

**I**NCISION of the incompletely dilated vaginal portion of the uterine cervix in labor was first definitely introduced by Dührssen, in 1890. With the development of analgesic agents, together with improvement in the technic of abdominal cesarean section, the indications and necessity for this operation were greatly reduced. The procedure, however, has certain well-defined indications, and a definite, if limited, field of usefulness. A number of factors have been mentioned as etiologic when dystocia exists.

Conditions of the cervix are as follows: Rigidity, with insufficient elasticity to allow dilatation, a condition which is presumed to be not uncommon among elderly primiparous women; fibrosis, which may be a result of preexisting chronic infection, with or without the added effects of such factors as too extensive treatment by cautery; old, extensive laceration, with attendant excess of scar tissue that does not yield under the influence of the uterine contractions; conglutination of the external os; previous operative procedures, such as high amputations or extensive trachelorrhaphy.

Anomaly of the powers of expulsion exists when contraction and retraction of the uterine musculature is not sufficient to accomplish obliteration of the cervical canal, and subsequent dilatation of the external os.

Disproportion between the size of the presenting part and the bony canal of the pelvis may lead to inability of the presenting part and bag of waters to act effectively on the cervix.

Anomalies of position and presentation of the fetus may exist, such as occipitoposterior positions and face presentations.

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Conditions associated with the amniotic sac are as follows: premature rupture of the membranes; abnormally tough membranes with delayed rupture; the so-called pathologic membranes, wherein the membranes are closely applied to the presenting part, with no forewaters to act as a dilating wedge, and adhesion between the membranes and the cervix in the region of the external os.

As far as the cervix itself is concerned, it would seem that the factors of consistence, thickness, and length, would determine the resistance to be offered to effacement of the cervix, and to dilatation of the cervical canal and external os. If the cervix is firm, scarred, hypertrophied, indurated, or badly infected, with resultant increase in firm, fibrous tissue, it might be presumed that more uterine contractions would be necessary to cause complete effacement and dilatation of the cervix. However, this does not necessarily follow, for one not infrequently notes, during the progress of pregnancy, a change in consistence of the cervix; it becomes soft, and with the onset of labor dilates with normal rapidity.

Probably conditions of the cervix in themselves are not as frequently the cause of failure of dilatation as are factors related to the powers of expulsion and the fetus. One of the most difficult things to evaluate in obstetric practice is the efficiency of a uterine contraction. What effect the contraction and retraction of the uterine muscle will have on a given cervix is unknown until trial of labor begins. It is also probable that the intensity of a given pain, as measured by palpation, is of more value in determining this point than the frequency or duration of the pains. A patient may have twenty pains in one hour, of the same duration as those of another parturient woman, who is having twelve pains an hour, but accomplish less. It has been stated by Calkins and his associates that accurate determination of the effectiveness of the labor pain, balanced against the resistance of the cervix and pelvic floor, is the all important factor in determining the length of labor. As is evident, effectiveness of uterine contractions is related to the retractive effort and the interval of relaxation between pains, as well as to the active stage of contraction. This is easily proved by the effect of analgesic agents during the course of the first stage of labor. Pains may be almost continuous and intense, as measured by palpation during the contraction, but progress in effacement and dilatation may be very slow. After administration of sufficient sedative to increase the interval between contractions, and so to allow an interval of relaxation, the cervix is rapidly dilated. How much actual relaxing effect there may be on the cervix is difficult to determine.

The effect of disproportion, and of anomalies of presentation and

position on effacement and dilatation of the cervix, is apparently one of inability of the presenting part, and of the amniotic sac, to apply themselves to the cervix sufficiently to carry out the usual dilating, wedge-like effect.

The effect of the hydrostatic dilating wedge on dystocia due to the cervix is inconstant. It has long been taught that premature rupture of the membranes in itself often leads to a long first stage of labor. Statistical studies have appeared which tend to refute this teaching. Randall and Schulze have both shown that, given a well-flexed vertex presentation with the occiput in the anterior half of the pelvis, without disproportion, labor is often shorter than the average. Dry labors that are long and drawn out are most frequently associated with some other complication, such as an occipitoposterior position, or disproportion between the presenting part and the pelvic canal. The so-called pathologic membranes, when the presenting part fits into the amniotic sac, with no forewaters, is not infrequently seen in cases in which the first stage of labor is slow; in these cases, rupture of the membranes is frequently succeeded by progress of labor. Abnormally tough membranes are occasionally encountered, as well as adhesions between the tissue surrounding the external os and the membrane adjacent to it, and may result in a slow first stage of labor.

Among 3,200 confinements on this service at The Mayo Clinic the uterine cervix offered definite obstruction to the progress of labor sufficient to warrant hysterostomatomy (incision of the vaginal portion of the cervix) in twelve. Dystocia due to incomplete dilatation of the cervix is probably less common than that due to other causes. This relative infrequency is no doubt due largely to the general practice of conservative obstetrics and the increasing use of analgesic agents in the first stage of labor.

The average age of this group of 12 patients was twenty-nine years; the oldest patient was aged thirty-six years and the youngest, twenty-two. One patient gave a history of late onset of menses and had been told previously that her uterus was underdeveloped; when seen by me she had been pregnant seven months, and there were multiple fibromyomas in the uterus. These tumors did not obstruct the birth canal. None of the patients gave histories of previous pelvic inflammatory disease or operative procedures on the genitalia.

The measurements of the pelvis of 9 of the 12 patients were within normal limits. Of the remaining 3, one had an estimated obstetric conjugate of 10 cm., and rather heavy pelvic bones. In 2 cases there was anteroposterior shortening of the pelvic outlet, and in one of these the spines of the ischium were prominent and both the intertuberal and the interspinal diameters were shortened.

The pregnancy had reached term, except in one case. In this case labor was induced at thirty-four weeks because of severe toxemia of the later months of pregnancy.

There were 11 primiparas (8 of these were primigravidas) and one was a multipara. Of the 3 primiparas who were multigravidas 2 reported previous miscarriages, with uneventful convalescence, and one of these 2 had also had an extrauterine pregnancy; the third patient had been delivered of a macerated fetus of twenty-four weeks without complication of labor or puerperium. The multipara had been delivered spontaneously at term nine years previously. Her postpartum course had been without incident. Operation for cholecystitis and appendicitis had been performed three years prior to this pregnancy. Nine of these 12 patients received prenatal care under my supervision and 3 were admitted to the hospital as emergency cases.

There were 2 patients with toxemia of the later months of pregnancy. In one of these cases there was severe preeclamptic toxemia, and the patient was seen as an emergency case at term. In the other case there was a similar condition, and the patient was seen as an emergency case in the thirty-fourth week; eclamptic convulsions developed after induction of labor by means of a Voorhees bag.

Labor was induced in one case with castor oil and quinine at term, and in 3 cases a Voorhees bag was inserted into the cervix. Two of the inductions by means of a bag were done in the presence of severe toxemia, one at thirty-four weeks of gestation and one at term, and the third induction was for the multigravida, who was at term. She had had labor pains for ten days before admission, with no evidence of cervical dilatation. This patient was considerably exhausted. Since a quarter of a grain of morphine hypodermically had no ameliorating effect on the pain or on the progress of labor, it was thought advisable to insert the bag.

Premature rupture of the membranes complicated 3 cases. In 2 cases the membranes ruptured at the onset of labor, and in one case they had ruptured forty-eight hours before the onset of labor.

The average length of labor before interference was forty-one hours, excluding that case in which the patient had had uterine contractions for ten days prior to admission. The longest first stage was fifty-five and three-fourths hours and the shortest, twenty-five and a half hours. In each case, complete effacement of the cervix occurred before interference was attempted. The amount of dilatation varied from 3 to 7 cm., an average of 4.4 cm. at the time of incision.

The second stage of labor averaged forty minutes in length; the longest second stage was one hour, and the shortest, nineteen minutes. The third stage of labor averaged eleven minutes in length; the longest time was fifteen minutes and the shortest, nine minutes. In each

instance the placenta was delivered by early expression after spontaneous separation and delivery from the uterus into the vagina.

Episiotomy was done in each case except the one case of the multi-gravida. In one case the perineum was "ironed" out before the episiotomy was performed.

The presentation was vertex in each instance. There were 5 cases of occipitoposterior positions, in 3 of which the position persisted and in 2 of which rotation became arrested deep in the pelvis, in the transverse diameter. In the cases of persistent occipitoposterior position, manual rotation was necessitated in two, and spontaneous rotation occurred in one after incision of the cervix. Manual rotation corrected one deep transverse arrest, and in the other Barton forceps were used.

Delivery was accomplished by forceps extraction in each case; in 8 cases mid forceps, and in 4, low forceps operations were done.

The average weight of the infants, excluding the premature infant, which weighed 3 pounds and 9 ounces, was 7 pounds; the largest baby weighed 9 pounds and 2 ounces, and the smallest 6 pounds and  $\frac{1}{2}$  ounce. The baby which weighed 9 pounds and 2 ounces was borne by a patient whose ischial spines were prominent, and narrowed the plane of smallest dimension definitely. A baby of 8 pounds and 12 ounces was borne by the oldest patient of the series (thirty-six years of age) who had normal pelvic measurements. A baby of 8 pounds and 9 ounces was borne by another patient, whose pelvic measurements were normal. An infant weighing 8 pounds and 12 ounces was delivered after arrest of rotation had occurred.

The puerperium was uneventful in 9 cases. The remaining three patients had complications as follows: one patient had had persistent jaundice during pregnancy, which had necessitated repeated duodenal drainage, and she came to delivery in rather poor general condition; she had a temperature of 102° F. on the second day after delivery but was subsequently afebrile. The patient who had eclamptic convulsions had a temperature of 102° F. two days before delivery, associated with an eclamptic convulsion. She remained afebrile after delivery until the twelfth and thirteenth day, when the temperature rose to 101° F. succeeded by normal temperature. One patient had a temperature of 101° F. on the seventh day and a chill and temperature of 105° F. on the eighth day, a drop to 101° F. on the ninth day, and a subsequent normal temperature. There had been retention of urine necessitating catheterization on the second, third, and fourth days after delivery. This recurred on the eighth, ninth and tenth days. With the establishment of spontaneous urination and the disappearance of residual urine in the bladder, the temperature remained normal.



In this group of twelve patients, eight were able to void spontaneously throughout the course of the puerperium. Four patients were catheterized, two for retention and inability to void, and two because of residual urine. One patient with retention has been mentioned, and for the other catheterization was necessary for the first seven days, after which spontaneous, complete emptying of the bladder occurred. In one case in which there was residual urine, the amount was reduced to 60 c.c. on the fifth day, and subsequent catheterization was unnecessary. Another patient had 500 c.c. of residual urine for the first two days, but was subsequently able to empty the bladder completely. Each patient was examined by rectum before dismissal, at which time there was no evidence of pelvic inflammatory disease. In my opinion there were no postpartum complications attributable to the type of labor or delivery.

#### PROCEDURE

Complete effacement of the uterine cervix is an essential condition for performance of hysterostomy. If this has not occurred, there has not been complete retraction of the parametrial tissue containing the blood vessels and ureter, and extension of the incision may result in injury to the vessels, with dangerous hemorrhage.

The presenting part must be engaged. A nonengaged presenting part, even though definite pelvic contraction cannot be demonstrated, contraindicates this procedure. The bladder and rectum should be empty.

The incisions in the cervix were made at points corresponding to 10:00, 2:00 and 6:00 o'clock on the periphery of the external os in five cases, and at 10:00 and 2:00 o'clock in four cases, and at 6:00 o'clock in only three cases. The site and extent of the incisions depended on the conditions present. In those cases in which only the posterior incision was made, the cervix had a very long posterior lip. In two cases, this operated actually to hold the presenting part from descent into the pelvis, and directed it toward the pubis instead of along the normal axis of the birth canal. With incision of the cervix, the presenting part reached the pelvic floor with the next few pains. In the cases in which incision was made at the positions 10:00 and 2:00 o'clock, the amount of dilatation was sufficient to have allowed manual dilatation to a diameter of 5 to 7 cm., but the cervix was firm and inelastic, and manual dilatation would have amounted to manual laceration. In these cases, as with an inelastic perineum, it was felt that a clean incision was preferable to laceration. The incisions at 10:00, 2:00 and 6:00 o'clock were performed in those cases in which there was dilatation of the external os of 3 to 5 cm.; in such instances possibility of extension of the incisions is more to be considered than

in those instances in which there is greater dilatation. A tentative attempt may be made to dilate manually, but in my opinion, if cervical incisions are to be made at all, they should be a primary procedure. Unsuccessful manual stretching leaves the cervix traumatized and edematous. Extension of incisions made following this are more likely to occur, repair is more difficult, and proper healing is interfered with.

After complete effacement of the cervix and engagement of the presenting part has occurred, the incisions are made as follows:

The patient is given sufficient anesthesia to relieve discomfort, but surgical anesthesia is avoided, for it is desirable to preserve uterine contractions. In the interval between pains the cervix is immobilized with a smooth forceps, but undue compression is avoided, in order to lessen injury to the tissues. Under guidance of the finger, the incision is then made at 6:00 o'clock to the vaginal fornix. If a pain occurs, the presenting part is restrained to prevent descent and possible extension of the incision. Between the next two contractions incisions are made at 10:00 and 2:00 o'clock. The patient is now allowed to have several uterine contractions. These usually have the effect of pushing the presenting part through the cervix and down to the pelvic floor. Delivery can then be accomplished by means of forceps, without danger of extending the incisions during application and traction. Delivery by forceps is probably preferable, for continued expulsive efforts on the part of the mother might produce extension of the incisions. There was no undue bleeding following the incisions in any case in my experience.

*Repair.*—The cervix is repaired after delivery of the placenta. To repair before this time renders exposure difficult and the subsequent extrusion of the placenta through the repaired cervix may interfere with the integrity of the suture line. The lower extremity of each side of the individual incision is grasped with a smooth forceps. Traction on the forceps, combined with retraction by the assistant, and pressure on the fundus above the pubis allows the upper angle of the incision to be brought into view and the tissue in this region accurately approximated. Interrupted mattress sutures of No. 2, twenty-day chromic catgut are inserted. The upper suture should include tissue above the upper angle of the incision to avoid the possibility of secondary hemorrhage. The remainder of the incision is then closed with three or four interrupted mattress sutures, the lower one approximating the edge of the external os. These sutures should be tight enough to close the incision, but not too tight, since necrosis in the knot may occur and interfere with healing.

Postpartum care does not differ from that usually followed. The patients are allowed to sit up on the eighth day after delivery, to be out of bed on the ninth day, and to go home on the tenth to twelfth day if they live in the immediate vicinity.

#### POSTPARTUM RESULTS IN TWELVE CASES

CASE 1.—Six weeks after delivery the episiotomy wound was well healed, the perineum was competent and the cervical incisions were well healed although there was an adhesion between the vaginal wall and the incision at 2:00 o'clock position. The os was small and clean. The uterus was well supported in good position and the adnexa were negative to examination.

CASE 2.—Six weeks after delivery the perineum was competent, the episiotomy wound was well healed and the cervical incisions were completely healed. The os was small and clean. The uterus was well supported and the adnexa were negative to examination.

CASE 3.—Eight weeks after delivery the result was excellent except that the posterior incision had not united, to a depth of 1 cm. The edges were clean.

CASE 4.—Eight weeks after delivery the result was excellent. There was a slight depression at the site of the incisions at 10:00 and 2:00 o'clock. Cervicitis was graded 1.

CASE 5.—The patient did not return for postpartum examination.

CASE 6.—There was separation of the incision at the position of 2:00 o'clock to a depth of 1 cm.

CASE 7.—Ten weeks after delivery the perineum was relaxed to Grade 1. There were lacerations about 0.5 cm. in depth at the incisions in the position of 10:00 and of 2:00 o'clock. The cervix was clean.

CASE 8.—Eighteen weeks after delivery none of the incisions had healed. There was complete laceration of the cervix to the fornices.

CASE 9.—The patient did not return for postpartum examination.

CASE 10.—Seven weeks after delivery the incisions were well healed. Cervicitis graded 3 was present with extropion. This condition was treated with cautery with satisfactory results.

CASE 11.—Six weeks after delivery the posterior incision was separated to a depth of 1.5 cm. The edges were clean.

CASE 12.—Four weeks after delivery the result was excellent.

#### COMMENT

It is difficult to establish exact causes for these 12 cases of cervical dystocia. Most of the causes of this condition enumerated earlier in the paper would not seem to apply. The only previously existing pelvic condition, multiple uterine fibromyomas, could be used as an explanation for one case. Besides this we were attempting to open an unprepared cervix in a primigravida six weeks before term. Perhaps if the condition of the patient had not been precarious on account of the severe toxemia, more time could have been taken and spontaneous dilatation might have occurred. In the remaining 11 cases, however, sufficient time would seem to have been allowed for spontaneous dilatation. It should be pointed out that the dilatation in each case remained stationary for several hours before interference

was decided on. These patients had an adequate amount of time without analgesia to accomplish opening of the cervix in the usual case. They also passed through a period of time in which sufficient analgesia was given to produce definite relief from pain, and the interval between pains was definitely increased with little effect on the amount of dilatation, conditions which, as a rule, lead to complete effacement and dilatation of the cervix. There is no doubt that employment of analgesic agents in the first stage of labor is of great aid in securing effacement and dilatation of the cervix. The average patient, besides receiving relief from pain, secures enough relaxing effect to shorten the period of dilatation. Personally, I believe this is due to increased efficiency of the uterus rather than to actual relaxing effect on the cervix.

It is perhaps significant that in 5 of these 12 cases, the fetus was in the primary occipitoposterior position. This is in keeping with the fact that in cases in which this complication occurs, first and second stages of labor usually are longer and more painful than in cases in which the occiput is primarily in the anterior half of the pelvis.

#### CONCLUSIONS

Hysterostotomy is of limited but definite usefulness. It should not compete in the mind of the obstetrician with cesarean section. The cervix should be completely effaced and the presenting part should be engaged if the operation is to be attempted. These conditions should be adhered to rigidly. Disproportion at the pelvic outlet is not of so much importance, although successful vaginal delivery should be expected before the operation is undertaken.

The operation is not justified as a rule until more than usual time has been allowed for spontaneous dilatation to occur. In the course of this time, there should be a period when sufficient sedatives had been employed to secure a definite period of rest for the uterus and for the patient.

# THE PUPILLARY TEST FOR THE DIAGNOSIS OF PREGNANCY

BASED ON THE OBSERVATION OF 382 PATIENTS

Z. BERCOVITZ, M.D., PYENGYANG, CHOSEN.

*(From the Department of Laboratories and Department of Gynecology, New York Post-Graduate Medical School and Hospital)*

THE object of this report is to record the progress which has been made in the study of the diagnosis of pregnancy by the simple technic of instilling the patient's blood into her own conjunctival sac and noting whether or not a change takes place in the size of the pupil. During this investigation 382 patients have been observed.

In a previous report<sup>1</sup> attention was directed to the fact that if the blood of a pregnant woman is withdrawn and rapidly centrifuged, the clear serum obtained therefrom instilled into her own conjunctival sac will cause an alteration in the size of the pupil. This change is either a dilatation or contraction, contrasted with the control pupil, occurs promptly, and in some cases lasts for several minutes. A similar reaction does not occur in nonpregnant women or in men, but it was noted that when the serum from a pregnant woman causes a change in her own pupil, it will also excite the same reaction of the pupil in nonpregnant women, men, rabbits, and cats. Serum which was stimulating to the pupil when withdrawn from the patient lost its activity after about two hours.

One of the difficulties in the original procedure was the necessity of securing 5 c.c. of blood and centrifuging for varying periods of time, until clear serum was obtained. The substitution of whole blood for serum, therefore, seemed highly desirable, if it could be utilized without affecting the reliability of the test. Several drops of whole blood were mixed with an equal amount of normal saline solution and the mixture instilled into the conjunctival sac of the patient from whom the blood was taken. There was a prompt, definite change in the size of the pupil, indicating a positive reaction, in a sufficient number of cases to demonstrate the feasibility of dispensing with centrifuging the specimen. Nonpregnant individuals were also tested and all of them failed to show any reaction. In some instances rapid blood clotting caused inconvenience, so a 10 per cent solution of sodium citrate was satisfactorily substituted for the normal saline solution.

<sup>1</sup>Bercovitz, Z.: AM. J. OBST. & GYNEC. 19: 767, 1930.

## SIMPLIFIED TECHNIC

The only apparatus required includes a small lancet for obtaining blood, a small receptacle, such as a hollow-ground glass slide, a medicine dropper, and a 10 per cent solution of sodium citrate. One drop of the sodium citrate solution is mixed with five or six drops of blood from the finger or ear, and the mixture immediately instilled into one eye of the patient. Instead of using a receptacle for mixing, a small glass pipette with a rubber bulb or a medicine dropper may be found convenient. A drop or two of the 10 per cent sodium citrate is taken up in the pipette and the blood then aspirated in the same way. These are then mixed and quickly instilled into the eye and the results observed. The pupils are examined with the patient looking at some object about six inches distant in order to note if the pupils are equal and regular. It is best to have the patient in a partly darkened room with a soft yellow light above and behind her. This method of illumination has proved universally satisfactory. It illuminates the eyes sufficiently and does not shine directly into the eyes causing a pupillary reaction to light. When the patient accommodates her vision to some nearby object the results are more uniform than when she makes an effort to relax the pupils to focus on one placed at a distance. If accommodation is adjusted to a near object, even if the pupillary reaction is manifested by a positive contraction of the pupil, the difference in size of the untested pupil is easily recognized. It is wise to make a preliminary test before instilling the citrated blood, to establish a basis for comparison after it has been dropped into one eye. Following the above described technic the pupillary reaction is prompt. One of two distinct reactions may be noted. One is dilatation and the other is contraction, either of which may be evident when the test eye is compared with the control pupil. The change in the size of the pupil is always sufficiently marked to be recognized and usually lasts for several minutes before returning to normal.

The test requires about two minutes, is clean and simple, and causes the patient little inconvenience. In over three hundred patients there has not been a single instance of complaint of pain in the eye or conjunctivitis. It should be emphasized that before carrying out this procedure both pupils should be carefully studied before the instillation is made. After dropping the citrated blood into one eye, both

TABLE I.—RESULTS IN NONPREGNANT INDIVIDUALS

	NUMBER OF PATIENTS	POSITIVE REACTIONS	NEGATIVE REACTIONS
Saline and Whole Blood Dr. Z. Bercovitz	19	0	19
Citrated Whole Blood Dr. Z. Bercovitz	63	0	63
Citrated Whole Blood Dr. John C. Du Bois	14	0	14
Citrated Whole Blood in Men Dr. Z. Bercovitz	16	0	16
Citrated Whole Blood (in Korean Women) Dr. Z. Bercovitz	25	0	25
Citrated Whole Blood (in Korean Women) Dr. A. E. Leadbeater	17	0	17
Total	154	0	154

eyes should be compared to determine if any change occurs on one side as contrasted with the other. Definite alteration in the size of the pupil of the tested eye without a similar reaction on the opposite side constitutes a positive reaction.

*Results in Nonpregnant Patients.*—One hundred and fifty-four patients were included in the group of nonpregnant individuals, and 16 of them were men. The pupillary test was negative in all cases (Table I). Most of the subjects were selected from the clinical material in the Gynecological clinics of the New York Post-Graduate Medical School and Hospital. The cases included a variety of conditions, salpingitis, ovarian disease, endocrine disturbances with amenorrhea, and induced and natural menopause. These patients were examined at different stages of the menstrual cycle and some were actually menstruating. Not a single false positive reaction was observed.

TABLE II.—RESULTS IN PREGNANT WOMEN

NAME OF DOCTORS	NUMBER OF CASES	POSITIVE REACTIONS	PER CENT POSITIVE REACTIONS	NEGATIVE REACTIONS	QUESTIONABLE REACTIONS
Dr. W. Woodrow	69	57	82.6	6	6
Dr. John C. Du Bois	11	10	90.9	1	0
Dr. A. E. Leadbeater (in Korean women)	8	7	84.2	0	1
Dr. Z. Bercovitz	88	75	84.2	8	5
Dr. Mary W. New	7	6	85.8	0	1
Total	183	155	84.7	15	13

*Results in Pregnant Women.*—The pupillary test for pregnancy was applied in 183 women in whom the diagnosis of pregnancy was finally confirmed. Of the 183 patients observed 155, or 84.17 per cent, showed a positive pupillary reaction (Table II). The patients tested by Dr. W. Woodrow and Dr. Z. Bercovitz were found in the Prenatal Clinics of the New York Nursery and Child's Hospital; those tested by Dr. John C. Du Bois were in the Clinic of Professor Walter T. Dannreuther in the New York Post-Graduate Medical School and Hospital. Dr. A. Evelyn Leadbeater's observations were in Korean women at the Pyengyang Union Christian Hospital, Pyengyang, Chosen (Korea). Seven cases were contributed by Dr. Mary W. New and taken from her private practice in Seoul, Korea.

In the series collected by Drs. Woodrow and Bercovitz many of the patients were under treatment for syphilis, but this did not seem to alter the reliability of the test nor eventuate in eye injury.

Thirteen reactions were regarded as questionable because it was not possible to ascertain definitely that the test was positive, although it seemed positive.

*Results in Questionable Case of Pregnancy.*—Observations were made in 40 patients; most of these were examined by Dr. John C. Du Bois in Professor Dannreuther's clinic in the New York Post-Graduate Medical School and Hospital. Three cases were added by me and 7 are included through the kindness of Dr. Mary W. New. This group is of particular interest because it summarizes some of the diagnostic problems confronting the physician. In several cases the pupillary behavior was the first evidence of the presence or absence of pregnancy. Twenty-one finally proved to be pregnant. Thirteen were not pregnant, and 6 did not return for further observations. One pregnant patient showed a positive pupillary reaction twelve days after the onset of her last menses. Another showed a positive reaction at sixteen days, and others at thirty-six, thirty-eight, forty-three, and forty-four days after the last menstrual period. In 4 of Dr. New's patients, there was definite oscillation of the pupil as compared with the control. This reaction was described in the first report and is indicative of a positive reaction. Those who were not pregnant failed to demonstrate any reaction.

A positive pupillary test is especially valuable evidence of pregnancy when correlated with the history and physical findings.

*The Pupillary Test After Parturition.*—Postpartum tests were made in 41 patients, with negative reactions in 34. In 7 cases the positive reaction persisted. One patient who manifested a positive reaction before labor showed a loss of response fifteen minutes after the delivery of twins.

*The Effect of Phenol on the Pupillary Reaction.*—Using a solution of 0.2 per cent phenol in normal saline solution, a group of patients were examined to determine if the phenol in the conjunctival sac would change the pupillary reactions in pregnant women.

A solution was prepared by mixing 3 c.c. of 1-1000 adrenalin hydrochloride with 1 c.c. of normal saline solution. This was instilled into the conjunctival sac of 5 pregnant women and in each instance a positive pupillary reaction occurred. Another solution was prepared by using the same amount of adrenalin hydrochloride, but instead of using normal saline, the 0.2 per cent phenol-saline solution was employed. After instillation of this mixture into the eye of the same patients no pupillary reaction took place. In 3 patients, during the course of a positive reaction induced with whole blood, one minim of the phenol-saline mixture dropped into the conjunctival sac immediately abolished the reaction. In 3 other cases which had previously reacted positively with blood, the test was repeated after first instilling the 0.2 per cent phenol-saline solution. No reaction occurred. It is therefore apparent that phenol instilled into the conjunctival sac, either before or during a pupillary reaction resulting from adrenalin or the patient's own blood, abolishes the reaction.



*The Pupillary Reactions Following the Instillation of Female Sex Hormone.*—Through the courtesy of Dr. Harry B. Van Dyke, of the University of Chicago, I received a solution containing an extract of "female sex hormone," which had been isolated from the urine of pregnant women. This extract was neutralized and then tested in the conjunctival sac of 14 pregnant women. No positive reactions were observed in any case. The same patients were then tested with their own blood and reacted positively. The neutralized extract was then injected into mice in conformity with the technic of Aschheim and Zondek. In all of the mice the Aschheim-Zondek test was positive. However, neutralized extract of female sex hormone will not reproduce the same reaction in the pupil of pregnant women as that produced by their own blood.

Sufficient evidence is at hand to warrant further investigation of the reaction in both clinical practice and animal experiments. Further research may establish a relationship between abortion and the pupillary reaction of pregnancy. The pupillary test should be evaluated in cases of ectopic pregnancy. The influence of the placenta on this reaction should be determined, as I have not ascertained whether the pupillary reaction is negative fifteen minutes after delivery of both infant and placenta.

I am now located in a mission hospital in Korea and have neither the clinical nor laboratory facilities for further research. Others more fortunately situated may pursue these studies to their logical conclusions.

#### SUMMARY AND CONCLUSIONS

1. The pupillary reactions of pregnant women, nonpregnant women, and men have been studied.
2. One drop of 10 per cent sodium citrate solution is mixed with 5 or 6 drops of the patient's blood and instilled into one eye. The other eye is used for control observation and comparison.
3. The test requires about two minutes and the reaction usually lasts for about five minutes.
4. Observations in 382 patients constitute the basis of this presentation.
5. One hundred and fifty-four individuals were not pregnant, and none of them showed a positive pupillary reaction. Sixteen of this group were men. There were no false positive reactions.
6. In 183 patients the diagnosis of pregnancy was confirmed by subsequent events. Of these, 155 or 84.7 per cent showed positive pupillary reactions. In one of them a positive pupillary reaction was found twelve days after the onset of the last menstrual period.

7. Forty-one postpartum cases were observed. Thirty-four had negative pupillary reactions. One patient who had a positive reaction before delivery was negative fifteen minutes after the delivery of twins and the placenta.

8. A 0.2 per cent phenol in normal saline solution will prevent or abolish a pupillary reaction of pregnancy.

9. Neutralized female sex hormone, isolated from the urine of pregnant women, failed to cause a pupillary reaction when instilled into the conjunctival sac of 14 pregnant women. All of these women reacted positively to their own blood.

10. A positive pupillary test is of great diagnostic value when correlated with the history and physical findings. The test should be used in all doubtful cases, even though it has not yet established a means of positive differential diagnosis between pregnancy and all other conditions.

The author wishes to express his indebtedness to Dr. Ward J. MacNeal and his staff in the Department of Laboratories, and Dr. Walter T. Dannreuther and his staff in the Department of Gynecology in the New York Post-Graduate Medical School and Hospital for their cooperation, courtesies, and provision of the necessary facilities for this investigation.

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## THE TREATMENT OF UTERINE BLEEDING WITH SNAKE VENOM (ANCISTRODON PISCIVORUS)

SAMUEL M. PECK, M.D., AND MORRIS A. GOLDBERGER, M.D., F.A.C.S.,  
NEW YORK, N. Y.

*(From the Division of Laboratories and the Gynecological Service of Mount Sinai Hospital)*

SUCCESSFUL attempts at nonspecific control of experimental purpura in animals<sup>1</sup> led Peck to treat patients suffering from hemorrhagic diathesis with snake venom. The observation was made that in women with thrombocytopenic purpura, the prolonged menstrual flow was checked. This led him to suggest that patients with prolonged uterine bleedings of various types might be treated with this therapeutic agent. A preliminary report was published.<sup>2, 3</sup> The cases reported in this communication were chosen for snake venom injection because of the failure of other forms of therapy during a long period of observation.

### METHOD OF ADMINISTRATION

The venom was used in 1:3000 dilution with sterile normal sodium chloride solution containing 1:10000 merthiolate. The venom was obtained through the courtesy of the Antivenin Institute of America (Mulford Biological Laboratories). It was given intradermally. The initial injection was 0.2 c.c. and subsequent injec-

tions were 0.4 c.c., given twice weekly. In this series of cases the therapy was continued for from three to six months. It is advisable to treat patients for at least three months even in the presence of marked clinical improvement before any conclusions are drawn as to the efficacy of the treatment. For the first five or six injections care should be taken that at least 10 cm. separate the injection sites from one another. It has been our rule to use the left arm, right arm, right thigh, left thigh, etc.

Figs. 1 to 5 schematically represent uterine bleeding in five of the cases treated with venom. The abscissae divide the schema into scant, moderate, and profuse bleeding.

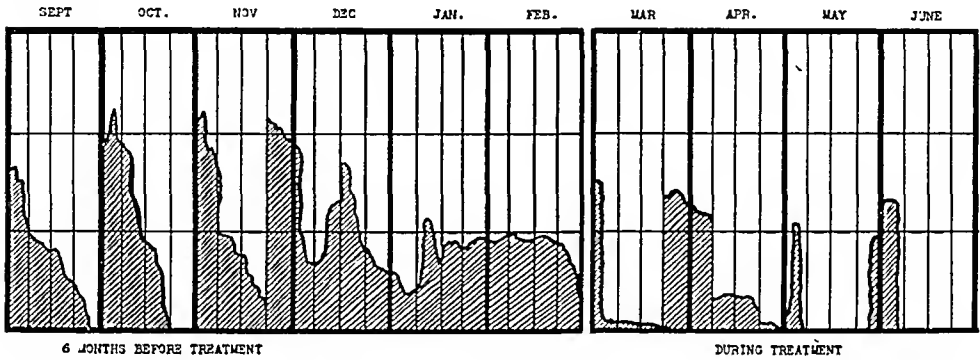


Fig. 1.—Case 6, Table I. D. G., nineteen years old. Single. Hgb. 18 per cent. Transfused 2 x. Cured 2 x.

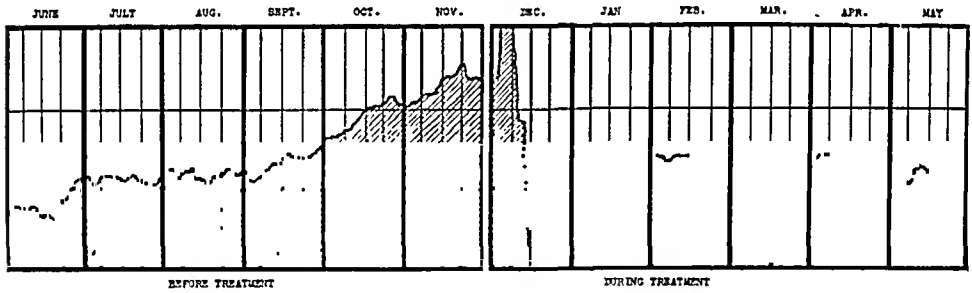


Fig. 2.—Case 2, Table I. M. J., twenty years old. Married. Hgb. 50 per cent. Transfused 2 x. Cured 3 x.

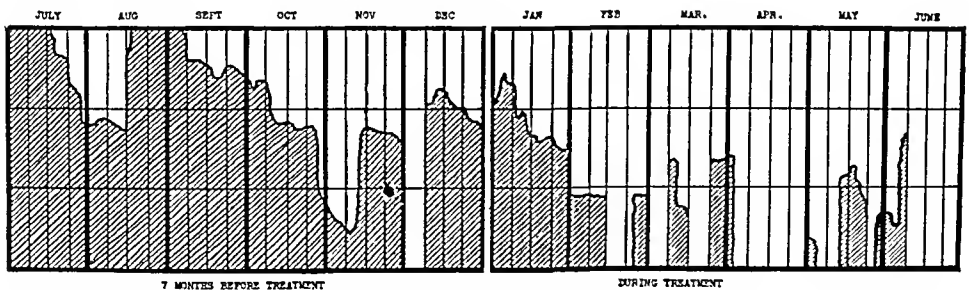


Fig. 3.—Case 5, Table I. A. C., fourteen years old. Hgb. 32 per cent. Transfused 4 x. Cured 1 x.

In some of the patients after 4 or 5 injections, a reaction of hypersensitivity to the snake venom protein may appear.<sup>4</sup> This is characterized by an egg-shaped erythematous swelling at the injection site which appears in from four to twelve hours and may last for as long as forty-eight hours. No general reactions have

been noted. When hypersensitivity occurs, it is advisable to reduce the concentration to 1:10000 with saline, but to continue the injections until a dose of 0.4 c.c. of 1:3000 is used. By this means, desensitization without any untoward reactions was obtained in practically all of the cases where it was attempted. The injections should be planned as follows: 0.1 c.c. 1:10000, 0.4 c.c. 1:10000, 0.2 c.c. 1:6000, 0.4 c.c. 1:6000, 0.1 c.c. 1:3000, and 0.4 c.c. 1:3000.

## CLINICAL DATA

Twelve patients were treated with snake venom for functional uterine bleeding. The effect of venom therapy upon the regulation of excessive uterine bleeding is illustrated in five of the cases in Figs. 1, 2, 3, 4, 5.

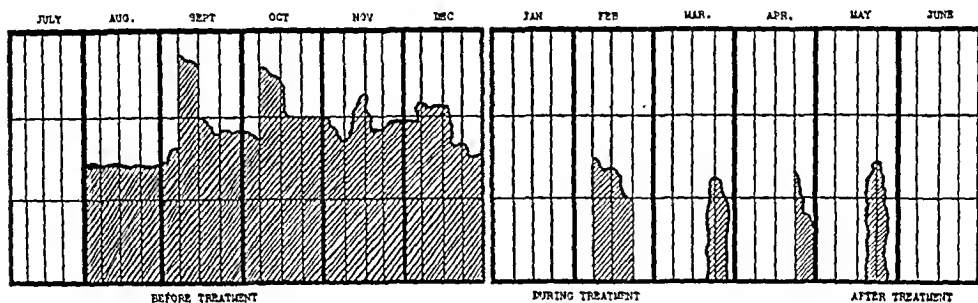


Fig. 4.—Case 3, Table I. M. J., twenty-two years old. Married four years. Para i. Hgb. 26 per cent. Transfused 3 x. Cured 4 x.

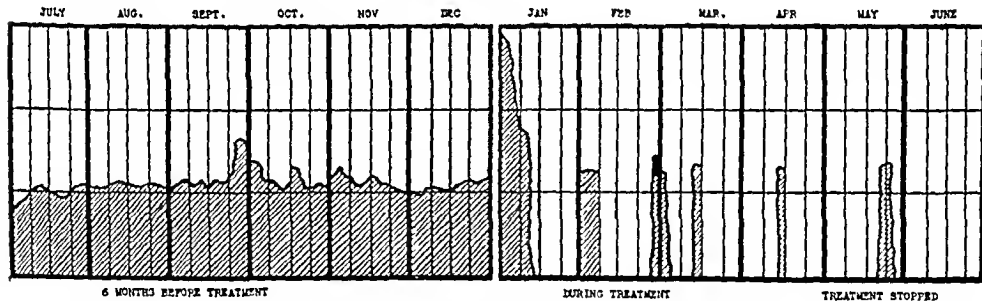


Fig. 5.—Case 4, Table I. M. K., seventeen years old. Single. Hgb. 54 per cent. Cured 2 x.

The shortest period of time in which bleeding was controlled was in Case 8. This was a twelve-year-old girl who began to menstruate August, 1931. The first three periods were approximately normal in amount and duration, but since January 1, irregular profuse bleeding developed. The history and gynecologic findings were essentially negative. At the time treatment was instituted, she had been bleeding for several weeks. The first injection, 0.2 c.c. of the 1:3000 solution was given on April 20, 1932, a like amount was given on April 22, 1932, and bleeding ceased on April 24, 1932. There has been no recurrence of uterine bleeding up to the present observation, June 14, 1932.

In most of the patients it required about six injections given over two to three weeks before any definite effect was noted. With the con-

TABLE I

NAME	AGE	PARITY	MENSTRUAL HISTORY	GYNEC. EXAM.	BLOOD COUNT	HOSPITAL TREATMENT	VENOM TREATMENT	COURSE
1. E. H. White	28	M. 2 years Sterile	13 x 28 x 6, 1 year. Irreg. bleeding, o e c. excessive, mostly moderate, at times scant with free interval	Neg.	Hg. 61% R.B.C. 485,000 Pl. 380,000 W.B.C. 10,200 P. 50% L. 43% Monos. 4%	1925 Curettage 1929 Curettage 1930 Curettage 1930 Ventrosusp. 1931 X-ray Spleen 1931 X-ray Pituitary	0.4 e.e.-1:3,000 intradermally weekly from 4/16/32 to 6/4/32	4(17-18-19) Mod. period 4/29 Bled 1 hour 5(4-5-6-7) Stain 5(8-9-10-11-12-13) 2 napkins a day Since—no bleeding
2. M. J. Colored	20	M. 3 years Sterile	13 x 28 x 4 up to 3 yr. ago. Irreg. 10-15 days profuse. Few dry clean intervals. Last 6 months cont.	Neg.	Hg. 50% R.B.C. 2,710,000 Pl. 200,000 Coag. 2½ min. Bled. 1 min. P. 5 to 42	1930 Curettage 1931 Curettage 1931 Curettage	0.4 e.e.-1:3,000 intradermally 2x wk. from 12/16/31 to 6/4/32	12/19/31 Bled. stopped 3/ 9/32 Bled 1 hour 3/23/32 Bled 5 hours 4/ 2/32 Bled 12 hours 4(3-4-5-6) Reg. period 5(10-11-12-13) Reg. period
3. M. J. Colored	22	M. 4 years Para. i	13 x 30 x 6. Irreg. and profuse for last 6 yrs. Bleeds cont. for 2 to 6 months	Neg.	Hg. 26% R.B.C. 2,100,000 W.B.C. 8,900 P. 84% L. 15% E. 1%	1926 Transfusion and Curettage 1930 Curettage 1931 Transfusion and Curettage 1931 Transfusion and Curettage	0.4 e.e.-1:3,000 intradermally 2x wk. from 12/21/31 to 4/27/32	2/14 to 2/20 Reg. period 3/23 to 3/27 Reg. period 4/22 to 4/27 Reg. period 5/28 to 6/3 Reg. period
4. M. K. White	17	Single	11 x 28 x 7 for 1½ years. Since, almost cont. bleed., at times profuse, lasting 7-8 months	Neg.	Hg. 54% R.B.C. 4,280,000 Pl. 260,000 W.B.C. 5,500 P. 63% L. 37%	1928 Curettage 1928 Curettage 1928 X-ray Ovaries	0.4 e.e.-1:3,000 intradermally 2x wk. from 1/6/32 to 4/30/32	1/ 3 to 1/10 Profuse 2/ 2 to 2/ 7 Reg. period 3/ 7 to 3/10 Reg. period 3/19 to 3/22 Mod. bleed. 4/18 to 4/23 Mod. bleed. 5/25 to 6/ 1 Mod. bleed.

TABLE I—Cont'd

NAME	AGE	PARITY	MENSTRUAL HISTORY	GYNEC. EXAM.	BLOOD COUNT	HOSPITAL TREATMENT	VENOM TREATMENT	COURSE
5. A. C. White	14	Single	11x28x7 for 8 mo. Irreg., profuse, scant, almost cont.	Neg.	Hg. 32% Bl. time 3 min. Coag. 7½ min. R.B.C. 3,000,000 W.B.C. 6,650 P. 63% L. 31%	1929 Curettage and Transfusion 1929 Transfusion 1930 Transfusion 1931 Transfusion	0.4 c.c.-1:3,000 intradermally 2x wk. from 1/30/32 to 6/4/32	1/23 to 1/30 Profuse 1/31 to 2/14 Slight to moderate 2/27 to 2/29 Scant 3/5 to 3/8 Scant 3/23 to 3/30 Moderate 5/24 to 6/8 Moderate
6. D. G. Colored	19	Single	12x28x6 until 2 yr. ago. Since, profuse to moderate cont. flow for 4 to 6 mo.	Neg.	Hg. 18% R.B.C. 1,800,000 W.B.C. 8,000 P. 85% L. 13% Monos. 2%	1931 Curettage and 2 Transfusions 1932 Transfusions	0.4 c.c.-1:3,000 intradermally 2x wk. from 3/9/32 to 6/4/32	3/13 to 3/16 Mod. flow 3/30 One day slight 3/31 to 4/14 Moderate 5/6 to 5/9 Moderate 5/31 to 6/4 Moderate
7. S. F. White	41	Single	11x28x4. Last 3 yr. of 2-3 weeks; 8 days profuse	Neg.	Hg. 57% R.B.C. 3,900,000 W.B.C. 6,100 P. 76% L. 20% Monos. 4%	1932 Curettage	0.4 c.c.-1:3,000 intradermally 2x wk. from 3/26/32 to 6/4/32	3/30 Spotting 1 day 4/16 to 4/21 Reg. period moderate 5/13 to 5/18 Moderate
8. N. R. White	12	Single	Began August, 1931. Reg. up to Jan. 1932. Since Jan. 1932 almost cont. irreg. bleed.	Neg.	Hg. 85% R.B.C. 4,600,000	None	0.2 c.c.-1:3,000 intradermally 2x wk. from 4/26/32 to 6/4/32	No bleeding since 4/27/32

TABLE I—CONT'D

NAME	AGE	PARTY	MENSTRUAL HISTORY	GYNEC. EXAM.	BLOOD COUNT	HOSPITAL TREATMENT	VENOM TREATMENT	COURSE
9. H. B. White	41	Married	Last 3 years profuse 8 days. In bed first 2 days	Neg.	Hg. 86% W.B.C. 13,750 P. 82% L. 16% M. 2%	None	0.4 c.c.-1:3,000 intradermally 2x wk. from 1/5/32 to 5/16/32	Since 2/1/32 periods have lasted 5 days and moderate
10. S. H. White	18	Single	Profuse periods lasting 6 days with nosebleed during 2-3 years with purpura	Neg.	Thrombocytopenia 84% Hg. 90,000 Pl. 8,500 W.B.C. 67% P. 32% L. 71%	None	0.4 c.c.-1:3,000 intradermally 1x wk. from 2/23/32 to 5/21/32	4/2/32 (Mod. period) No nosebleed 5/21/32 (Mod. flow 4 days, no nosebleed)
11. R. C. White	33	Married	Profuse 6-7 days with purpura at each period and nosebleed. Duration 2 yrs.	Neg.	Hg. 4,500,000 R.B.C. 140,000 Pl. 6,000 W.B.C. 52% P. 47% L. 54%	None	0.4 c.c.-1:3,000 intradermally 1x wk. from 1/12/32 to 3/15/32	1/26/32 (Mod. period, no purpura) 2/29/32 (Mod. period, no purpura)
12. M. H. White	30	Married Para. i	13x28x6 up to 3 years ago. Since, irregular, profuse, at times continuous for an entire month	Adherent, retroflexed uterus. Macrocyts in both ovaries	Hg. 54% R.B.C. 3,260,000 Pl. 47% W.B.C. 52% P. 47% L. 54%	1930 Curettage 1931 Curettage 1931 Curettage	0.4 c.c.-1:3,000 intradermally 2x wk. from 1/30/32 to 2/10/32, then 1x wk. to 3/17/32 3x wk. from 3/17/32 to 3/25/32	2/ 9/32 Bleeding stopped 2/27 to 3/4 Mod. flow 3/17 to 3/25 Mod. to profuse flow

trol of the uterine bleeding, there was a rapid improvement of the secondary anemia usually present. Ten of the cases responded well. In one, the final result was poor (Case 12).

This patient, a thirty-year-old married woman, gave a history of irregular and profuse uterine bleeding for three years. The gynecologic findings were adherent retroflexed uterus and bilateral macrocystic ovaries. She had had three curettages with only temporary relief. Venom treatment was begun Jan. 30, 1932, during a period of profuse bleeding which had lasted over a week. The injections were continued twice a week, the average dose being 0.4 c.c. of the 1:3,000 solution. After four injections given in ten days, the bleeding stopped. The injections were then continued at weekly intervals until March 17. Bleeding began again on February 27 and lasted for six days; scant bleeding for the first three days and moderate bleeding for the last three days. On March 17 she started to spot and from March 19 to the twenty-fifth there was a heavy flow. During this bleeding period, she received three injections of venom. After an injection on March 22, the bleeding diminished very much and on March 25 it stopped. She then became sensitized to the venom protein so that the dosage had to be markedly reduced. Bleeding began again April 29 and lasted nine days, moderate flow. She was then desensitized with further injections of venom and from May 24 to June 3 she received four injections of 0.4 c.c. 1:3,000 solution. She began to spot on May 19 and then bled actively until the last observation June 7. In view of the fact that she was bleeding very profusely, in spite of the long course of venom injections, it was decided to discontinue treatment with venom. She was operated upon for her retroflexion of the uterus and bilateral macrocystic ovaries. Subsequently patient died. Autopsy showed a peculiar type of generalized Hodgkin's disease.

In Case 5, Fig. 3, the result was only fair, although the uterine bleeding was controlled. There were five menstrual periods of three to seven days' duration from February to May. From May 24 to June 7, 1932, there was a scant flow for five days, moderate for three days and profuse for the last six days. Because of this long period, this case will require further treatment and observation before it can be accepted as markedly improved.

#### SUMMARY

The therapeutic effect of moecasin venom (*Ancistrodon piscivorus*) on twelve cases of functional uterine bleeding is presented. The period of observation is too short to draw any final conclusions about the permanence of the results. The therapeutic effects obtained are satisfactory enough to warrant the clinical trial of venom therapy in cases of this type.

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- (3) Frank, Robert T.: AM. J. OBST. & GYNEC. 24: 574, 1932.
- (4) Peck, Samuel M.: Arch. Derm. & Syph. 27: 312, 1933.

125 EAST 72ND STREET.

145 WEST 86TH STREET.



## ABRUPTIO PLACENTAE

ISADORE A. SIEGEL, A.B., M.D., BALTIMORE, MD.

*(From the Obstetrical Department University of Maryland Medical School)*

**A**BRUPTIO placenta, ablatio placenta, and premature separation of the placenta are terms which are used to describe one and the same condition; namely, the premature separation of the normally implanted placenta, which generally occurs in the latter months of pregnancy or during labor. It is this clinical entity which I wish to consider after analyzing the cases as they occurred in the University Hospital of the University of Maryland Medical School.

We report here 62 cases of abruptio placenta which were treated in the University Hospital from 1923 to 1931 inclusive. During this period of time we delivered approximately 3000 patients. These cases include all degrees of separation from the mildest with visible hemorrhage occurring late in labor to the severe type of complete separation with concealed hemorrhage and one case of placental apoplexy or the so-called Couvelaire uterus. This gives us an incidence of 1 in 48.39 cases. The incidence reported by others varies from 1-200 to 1-400 cases. Our series and incidence, therefore, is quite unusual. In order to make this high incidence understandable, it is necessary to know that the University Hospital has a limited number of maternity beds; that it serves as an outlet for the pathologic cases from our own Out-Patient Department where we deliver from 1200 to 1500 patients annually. That we receive practically all the abnormal cases from the City Obstetrical Service and that we likewise receive many of the pathologic cases from the city and state physicians. In other words, our beds of necessity are restricted to abnormal and pathologic cases. This consequently increases our incidence in all our pathologic cases; therefore, we do not represent the more true incidence of abruptio placenta as it occurs in hospitals having a more normal population.

Premature separation of the normally implanted placenta occurred in 35 white and in 27 negro patients, showing a slightly higher incidence in the white patients.

There were 5 cases occurring between the ages of fifteen and nineteen; 26 between twenty and twenty-nine; 31 between thirty and forty years. The age of the youngest was fifteen and the oldest forty years. The condition in our series occurred most frequently during the active period of reproduction.

There were 10 cases in the primiparas and 52 in the multiparas, indicating that abruptio placenta is most prevalent in the multiparous but is not uncommon in the primiparous woman.

Six cases occurred between fourteen and twenty-nine weeks' gestation; 25 between twenty-nine and thirty-seven weeks; 31 between thirty-eight and forty weeks. The case of fourteen weeks was one of twins. These figures seem to indicate that premature separation of the placenta is apt to occur most frequently after the period of viability.

There were 49 cephalic presentations, 7 podalic, 1 transverse, and in 5 the presentation was not noted.

In attempting to analyze the possible etiologic factors in these cases, we found that 37 patients showed no abnormalities and 8 patients showed only a trace to 1-plus albumin in the urine. Three cases occurred in preeclampsia, 1 case in eclampsia, 1 case in undetermined toxemia, 1 case in pulmonary tuberculosis, and 1 case in possible trauma; 2 patients had only hypertension, 7 patients had nephritis, and 3 patients had syphilis.

In the 45 cases that showed no real pathology, 16 patients had only slight bleeding, 11 moderate, and 19 profuse bleeding. In the entire series, however, 24 patients had slight bleeding, 17 moderate, and 21 profuse bleeding.

Our treatment of these patients was varied. Twenty-one patients were permitted to deliver themselves spontaneously; 5 had the membranes ruptured artificially with spontaneous delivery; 2 patients were bagged and allowed to deliver spontaneously. There were 8 forceps deliveries; 8 versions and breech extractions; 4 cases of breech extractions; 1 case bagged and delivered by breech extraction. There were 10 patients delivered by classical section and 1 patient by laparotrachelotomy.

The supportive treatment in these cases consisted of 10 per cent glucose intravenously in 2 cases, saline and glucose intravenously in 6 cases, and saline infusion alone in 14 cases. Two patients received preoperative blood transfusions, 3 patients, postoperative blood transfusions. In only 2 cases was it found necessary to pack the uterus.

There were 6 maternal deaths (9.68 per cent). This is an uncorrected mortality. One patient died of peritonitis, 1 of miliary tuberculosis, and 1 of ruptured uterus. There were 2 cases of hemorrhage and shock, and 1 case of postoperative pneumonia. The following are brief abstracts of the cases terminating fatally:

CASE 1.—No. 41582. C. M., negro, aged twenty-four, para v, admitted Dec. 31, 1924, with a history of pain in abdomen for twenty-four hours. She said she hurt herself carrying a basket of clothes on Dec. 29, 1924, and on the following day at 5:00 A.M. she began to have pains. Examination showed uterus tense and rigid and extending to ensiform cartilage. Fetus could not be outlined nor fetal heart heard. She was given continuous saline infusion, cervix was manually dilated and version with breech extraction performed delivering a twenty-eight-week stillborn fetus, followed immediately by the free placenta and many old blood clots. The uterus contracted down well and no more bleeding occurred. Patient was shocked

and despite all stimulation died seven hours postpartum. This case illustrates the great danger of dilating the cervix by accouchment force.

CASE 2.—No. 42526. F. C., negro, aged thirty-four, para v, was admitted on March 14, 1925, after having been in labor for twenty-four hours, with the uterus in a state of tetanic contraction and with slight vaginal bleeding. Fetus could not be outlied nor fetal heart heard. The pulse was 120, and temperature 99.6°. Saline infusion given. Vaginal examination showed cervix to be fully dilated and head floating. In attempting to do a craniotomy the head slipped away and the feet could be felt so that an easy version and breech extraction was done. The placenta was lying free in the uterine cavity from which it was removed with many old blood clots. One hour after delivery the patient's condition was grave but she improved under stimulates and infusions. She vomited and upon gastric lavage a large quantity of black tarry fluid was obtained. The next day she had a hematemesis and passed blood per rectum. Horse serum and other symptomatic treatment failed and she died on the third day. Autopsy showed gangrenous endometritis with perforation of the lower anterior wall of the uterus, hemorrhage in the peritoneal cavity, acute generalized peritonitis, acute diphtheritic inflammation of the esophagus and stomach, acute eutercolitis and acute nephritis. It is quite possible that the operator in the attempt to perforate the fetal head may have perforated the anterior uterine wall without having been aware of it.

CASE 3.—No. 49685. L. Mc., aged thirty-two, white, para iii, was admitted Aug. 26, 1926, with history of bleeding, beginning at 6:00 A.M. and with slight abdominal pain. The pain and bleeding gradually increased and the uterus became more and more rigid. At 12:00 noon when she arrived at the hospital, her pulse was 144, uterus rigid and tender, fetus could not be outlied and duration of pregnancy was thirty-six weeks. The cervix was 3 fingers dilated. She was given saline infusion, the cervix was manually dilated and a stillborn fetus was delivered by breech extraction. Placenta and many old blood clots were removed. The patient was shocked and failed to rally, dying at 2:00 P.M. This is another case showing the danger of accouchement force.

CASE 4.—No. 55651. L. S., aged twenty-one, white, para i, admitted Oct. 23, 1927, with history of having bled one month ago and began to bleed profusely today. She was examined at home vaginally by midwife and doctor. This was learned after the patient was operated upon. Her pulse was 96, temperature 98.6°, blood pressure 122/70, R.B.C. 2,900,000, Hb. 38 per cent, abdomen tense and tender, fetal heart not heard, cervix closed. She was given a blood transfusion of 500 c.c. and delivered by laparotrachelotomy. A large amount of serosanguineous fluid was found in the abdominal cavity. The placenta was lying free in the uterine cavity which contained much blood. During the operation the patient received 700 c.c. saline by infusion. Postoperative her pulse was 102, temperature 99°, blood pressure 88/54. She received 2 postoperative blood transfusions of 500 c.c. and 300 c.c. respectively. She ran a stormy course and died fourteen days postoperative of generalized peritonitis.

CASE 5.—No. 56007. B. H., aged thirty-two, negro, para vi, admitted Nov. 24, 1927, because of tense and tender abdomen with external bleeding. On November 22 she had slight pain in her abdomen which became worse the next day with some bleeding. The uterus was the size of thirty-eight weeks' gestation, very tender, hard and firm, R.B.C. 2,000,000, Hb. 33 per cent, pulse rose from 84 to 118, blood pressure 118/60, cervix 1 finger dilated. She was given morphia, saline infusion and 600 c.c. of glucose intravenously and delivered by classical section. The uterus was dark blue and mottled. A thirty-six-week stillborn fetus was delivered

and many blood clots found in the uterus. The uterus contracted on stimulation. The blood pressure dropped to 78/46 but rose the next day to 110/60. Forty-eight hours postpartum she developed pneumonia and died Nov. 26, 1927. This case perhaps may fall in the class of the Couvelaire uterus.

CASE 6.—No. 60067. L. J., aged thirty-three, white, para viii, was admitted with history of having bled six weeks ago and began to bleed again. She was about twenty-two weeks' pregnant, very pale, and emaciated. Lung examination showed miliary tuberculosis. Patient ran a typical septic course, placenta previa was ruled out but she continued to bleed, and it was deemed advisable to interrupt her pregnancy. On the tenth day in the hospital, her cervix was packed and she delivered herself the next day without any difficulty. Her condition became rapidly worse, and she died on the seventh day postpartum of diffuse miliary tuberculosis.

Fetal mortality: There were 36 fetal deaths (57.1 per cent). Of this number 16 were premature stillborn including one pair of twins, 16 full-term stillborn babies and 5 premature born alive but which died before leaving the hospital. There were 7 premature and 19 full-term living babies discharged from the hospital.

Morbidity: There were 21 cases showing a morbidity. Among this number was 1 case of wound infection, 1 of phlebitis, 1 of bronchopneumonia, 1 of pyelitis, and 1 of puerperal psychosis.

2309 EUTAW PLACE

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## RETZIUS SPACE ABSCESS FOLLOWING LAPAROTOMY\*

E. EDWIN REEVES, M.D., AMARILLO, TEXAS

**S**UPPURATION in the area designated by Retzius as "the space in front of the bladder" is infrequent, and exceedingly rare following simple laparotomy. This prevesical space received the name *caelum Retzii*, since Retzius gave its clinical applications in a paper before the Academy of Stockholm in 1856. In reality, there is no cavity present, but the space is occupied by loose areolar and adipose tissue.

A review of the literature reveals comparatively few articles dealing with the Retzius space abscess, and the genitourinary surgeons have written more extensively than others upon the subject. Goldstein and Abeshouse conclude that prevesical infection frequently occurs as a complication of suprapubic cystotomy and results from flooding the operative field with septic urine. In earlier reports we find that Budin described a case in a child of thirteen days of age that came to autopsy, and in which he demonstrated streptococci as the causative factor. Marten operated upon a child sixteen months of age with excellent results, this being the first operation for prevesical abscess in a patient less than eight years of age. Michels reported four cases of prevesical ab-

\*Read before the Amarillo Academy of Medicine, March 29, 1932.

secess in 1895, giving the etiologic factors, diagnostic methods, and treatment. Little change could be made at the present time of the facts he stressed in his paper. In 1903 P. Targhetta rendered an extensive report of a case in a male four years of age, which developed after a kick in the abdomen. He confirmed the diagnosis by exploratory suprapubic puncture, following which he performed an operation by vertical suprapubic incision with successful results. The culture was pure streptococcus, and Targhetta concluded that the infection came from a lesion in the bladder mucosa, by way of blood or lymph stream. The lesion resulted from the injury, whereas, the bacteria came from the urine. Chatillon, at a later date, gives a somewhat similar explanation of infection spreading by the hematogenous route. His was the case of a young woman, who in early puerperium, developed bronchopneumonia, which was in turn followed by prevesical abscess. The coughing was the exciting factor in producing bronchial lesions, thereby allowing infection to gain the blood stream. However, in his case the pus from the abscess was sterile. Nevertheless, this author cites the case of Kummer in which the Retzius space abscess followed pneumonia, and pneumococci were found in cultures from the abscess. Mention should be made of the case reported by Brun, which was of appendicular origin and at a later stage ruptured into the bladder. Likewise, the case of Kuhn, which was of traumatic origin, is interesting.

In this presentation, an attempt will be made to demonstrate an unusual complication of laparotomy for pelvic disease of women, and to study the anatomical relationship, causative factors, and prevention.

The prevesical space of Retzius lies above the pubovesical ligament; its lower anterior boundary consists of the symphysis pubis and the side walls of the pelvis; the upper anterior boundary is the transversalis fascia; the posterior boundary consists of the anterior border and the inferolateral surfaces of the bladder, with also the lateral false ligaments which stretch from each lateral superior surface of the bladder to attach to the side walls of the pelvis. The upper limit is marked by the anterior peritoneal reflection together with the urachus, which extends from the apex of the bladder to the umbilicus; but Graves describes also a thin membranous fascia called the umbilicovesical fascia, which comes from the pelvic floor and passes over the bladder to the abdominal wall and fuses with the transversalis fascia. Some authors describe this fascia as being attached at the semilunar fold of Douglas. The space contains the anterior and lateral lymph glands of the bladder and portions of the hypogastric group in relation to the hypogastric arteries. The last named group has connections with the parauterine and anorectal glands.

By keeping in mind the above mentioned anatomical features, and remembering the fact that the prevesical space is entirely extraperi-

toneal, we can more readily comprehend the case herewith reported and the operative technic used.

#### CASE REPORT

Miss X., clerk, aged eighteen, reported for office examination on Sept. 24, 1931, complaining of vaginal discharge, lassitude, occasional feverish and chilly sensations, lower abdominal discomfort, backache, and occipital headache. The infection was contracted six months previously following sexual exposure, and she had experienced mild acute upsets at varying intervals. The discharge was of creamy yellowish type, and there was some accompanying vesical irritation.

Her menses began at the age of twelve years and were normal until the onset of present illness, when she developed backache and occasional clots.

The family history was negative; her past history revealed marked constipation for the past two years, and pleurisy in 1929. The general physical examination was negative, except for hypertrophied tonsils and the abdominal and pelvic findings. There were no palpable masses in the abdomen, however, tuboovarian tenderness was present. The vagina was congested and contained a mucopurulent discharge; the uterus was slightly retroverted; both tubes were enlarged and moderately tender; the cervix was eroded. The urine was negative; the W.B.C. count was 10,400; the R.B.C. count 4,250,000; and the cervical and urethral smears revealed gram-negative intracellular diplococci.

She was given expectant treatment for a few days, but was admitted to St. Anthony's Hospital on October 2. She was operated upon the following day under spinal anesthesia of 200 mg. novocaine. The operation consisted of cervical cauterization, bilateral salpingectomy, right oophorectomy, and appendectomy; also the round ligaments were shortened somewhat to provide adequate uterine support. The pathologic report revealed chronic bilateral pseudofollicular salpingitis; small cystic follicular atresia of the ovary; and chronic appendicitis.

The immediate postoperative recovery was excellent, however, there was an early rise in temperature and a somewhat atypical septic chart continued after the second postoperative day. She had some nausea and vomiting and a fair amount of abdominal distension, though she retained a reasonable amount of nourishment, and physical depletion was not rapid. At times she had slight pain in the lower abdomen, but there was no infection of the incision. There was considerable restlessness and mild delirium on October 9, when the temperature arose to 104.2° F. A malarial smear made at the time was negative. Even though a careful abdominal and vaginal examination was made, I was unable to determine the nature of the complication. There was a slight improvement following this, but the temperature peaked again on October 13, reaching 103.4° F. This followed a second vaginal examination which was made on the previous day, and in which I was again unable to make a diagnosis. At this examination, eight ounces of residual urine was removed by catheter, this being the only instance of urinary dysfunction during the entire illness.

On the morning of October 14 (the eleventh postoperative day), a third abdomino-vaginal examination revealed definite evidence of fluctuation behind the symphysis, also slight fulness of the iliac regions. Nevertheless, the patient did not experience any significant pain during the examination. A diagnosis of Retzius space abscess was made and was confirmed by Dr. W. Forest Dutton. Consequently, that afternoon the abscess cavity was opened by a vertical suprapubic incision close to the symphysis, under nitrous oxide anesthesia. The abscess cavity was immediately in front of the bladder, and, laterally, it occupied both paravesical fossae. It evidently contained about 250 c.c. of the dark brown pus, however, no aspiration was done. The pus had the characteristic odor of colon bacillus infection. The abscess cavity

was entirely extraperitoneal, and the upper limit of extension was only about 3 cm. above the symphysis, thereby, confirming Graves' contention of fascial relationship.

It is well to explain the secondary operation in more detail. The suprapubic incision was made at the extreme lower end of the initial incision. The lower fascia was found firmly united, and a scalpel was used in opening the abscessed cavity. Above, however, the recti fascia had separated its entire length. There was no pus in the original incision, but there was a small thread-like clot between the recti bellies of the upper half of the incision. I am inclined to believe that this clot resulted from my injudicious probing a few days prior to operation. The peritoneum was intact throughout. Closure was accomplished by interrupted chromic catgut to fascia, silkworm gut stay sutures, and dermal to skin. A Penrose drain was placed in each paravesical fossa, and a tube drain was inserted between these and in front of the bladder.

Immediate improvement took place, and convalescence was uneventful, except for slow healing of the drainage wound. (The blood Wassermann was negative).

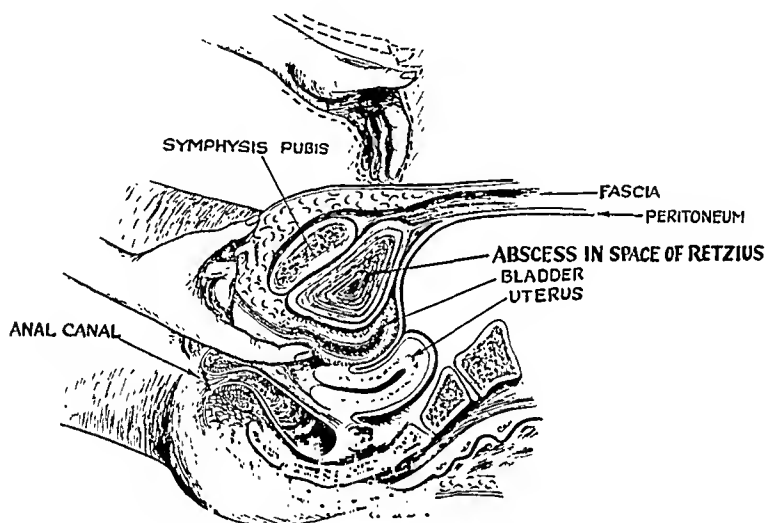


Fig. 1.—Showing Retzius space abscess and method of diagnosis: a definite fluid wave after catheterization, distorted bladder and displaced uterus.

On November 9, under one per cent novocaine anesthesia, three silkworm gut stay sutures were placed so as to hasten repair of the drainage wound.

Just before operation the W.B.C. count was 21,400; R.B.C. count 3,500,000; hemoglobin 75 per cent; polymorphonuclears 83 per cent. Several other counts were made postoperative and revealed a continued reduction of leucocytes and polymorphonuclears. The anemia was rather marked and was combated with intravenous iron and arsenic, tonics, and liver diet. A month after operation, the W.B.C. count was 9,150; R.B.C. count 3,820,000; hemoglobin 75 per cent; polymorphonuclears 62 per cent.

A vaginal examination on November 18 (five weeks after the secondary operation) revealed the uterus in normal position and freely movable. There was no tenderness in the lateral fornices and no cervical erosion. The patient left the hospital in good condition on November 20, and continued to gain weight and strength. When examined on Jan. 23, 1932, she weighed 122 pounds, which was very satisfactory inasmuch as her weight when she regained the chair on November 3 was 105 pounds, and her former normal weight was 120 pounds. The abdomen revealed marked cicatrization, but there was good recti function and no diastasis.

Catheterized urine specimens indicated the presence of a low grade pyelitis, which developed after the initial operation, but began to subside after the secondary operation. This feature made the diagnosis of the complication more difficult.

#### DISCUSSION

The etiology of the secondary infection is debatable, however, it is likely that it was of colon bacillus type, and was probably spread by lymphatics. Since colon bacilli are frequently present in the vagina and cervix, the cervical cauterization may have stimulated an extension to the parauterine nodes. Also, due to prolonged constipation and stasis, it is possible that the anorectal nodes may have become infected at a time of lowered resistance. The urine may have contained colon bacilli and infection could have easily been transmitted to the anterior and lateral lymph glands of the space of Retzius. Even though care was exercised, it is quite possible that a small bleeder was overlooked, and there may have been a collection of blood in the prevesical space, thereby supplying an excellent media for bacterial growth. In my eagerness for good pelvic exposure, it is probable that the incision went beyond the apex of the bladder, and in front of it, thereby exposing the space of Retzius. This would explain the possibility of a hematoma occurring in the prevesical space.

#### CONCLUSIONS

1. Statistics reveal that Retzius space abscess occurs most frequently in the young.
2. It is most frequent after certain bladder operations, but is rare following a gynecologic laparotomy.
3. The almost complete absence of vesical symptoms in this case is striking.
4. Early diagnosis is difficult.
5. Care should be exercised in making incisions so as to avoid entering the prevesical space, and a more careful search for, and tying of, bleeding vessels should be done.
6. Drainage of suspicious cases is important. This case, however, appeared sufficiently clean, and intraperitoneal drainage would have been of no value.
7. Cultures should be made to determine the exact nature of the infection; therefore, the author offers apologies for neglecting this feature in the case just reported.

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605 OLIVER-EAKLE BUILDING

## ADENOMYOMA (ADENOMYOSIS OF FRANKL) OF THE UTERUS WITH TUBERCULOUS INFECTION

R. H. RIGDON, M.D., DURHAM, N. C.

(From the Department of Pathology, Duke University School of Medicine)

THE frequency of adenomyoma of the uterus is evident from Cul-  
len's study of 1283 myomas<sup>2</sup> in which he found an incidence of  
5.7 per cent.

Tuberculosis of various portions of the female genital tract is by  
no means a rarity. According to Williams<sup>3</sup> the order in which the  
various pelvic organs are involved is as follows: tubes, uterus, ovaries,  
vagina, cervix, and vulva. On the other hand tuberculosis limited to  
the myometrium is very rare. In a series of 200 cases of tuberculous  
salpingitis, Greenberg<sup>4</sup> found the myometrium involved alone in only  
four cases. It is evident from this that the combination of adeno-  
myoma and tuberculosis would indeed be a rarity.

Von Recklinghausen<sup>5</sup> in 1896 reported the first two cases of adenomyoma of the  
uterus with tuberculous infection. The first occurred in a woman forty-four years  
old, who was sterile. The patient had dysmenorrhea all her life and during the  
four years previous to operation became severely anemic due to hypermenorrhea.  
The tumor removed at operation was somewhat smaller than a fetal head and on  
microscopic examination it showed dilated gland-like spaces and tubercles spread  
throughout the entire uterine wall. One portion of the tumor showed an adeno-  
carcinoma in addition to the adenomyoma and tuberculosis. The second case was  
that of a woman fifty-five years of age who was also sterile. This patient reached  
her menopause at thirty and during the ten years previous to operation she had  
irregular intervals of bleeding. The tumor removed at operation was approximately  
the size of a closed fist and on histologic examination showed a carcinoma of the  
endometrium and an adenomyoma with a tuberculous infection.

Von Recklinghausen at first ascribed the origin of adenomyomas to the re-  
mains of the wolffian body; however, he later reported one case in which the  
glands in the myoma evidently grew from the glands in the endometrium and he  
therefore reached the conclusion that although most adenomyoma arise from the  
remains of the wolffian body others have their origin from the uterine mucosa.

Since von Recklinghausen's monograph the occurrence of the combination of  
tuberculosis and adenomyoma has proved to be rare. Johnstone,<sup>6</sup> in 1924, found  
only 6 cases in the literature and to this he added another. To these should be

added the cases of Dickson<sup>7</sup> and Gage,<sup>8</sup> making a total of 9 cases reported to date. Moench,<sup>9</sup> in 1923, reviewed the literature in a study of "Tuberculous Ovarian Cyst" and was able to find only 33 authentic cases. The majority of these cases occurred in intraligamentous and dermoid cysts. Likewise rare is the combination of tuberculosis with or in ovarian tumors.

Recently we have had the opportunity to study a case illustrating both these rare conditions, namely, adenomyoma of the uterus and cystadenoma of the ovary, both accompanied by tuberculosis.

#### CASE REPORT

Our case occurred in a white female forty-nine years of age whose chief complaint was irregular menses. Menstruation began at the age of seventeen and each

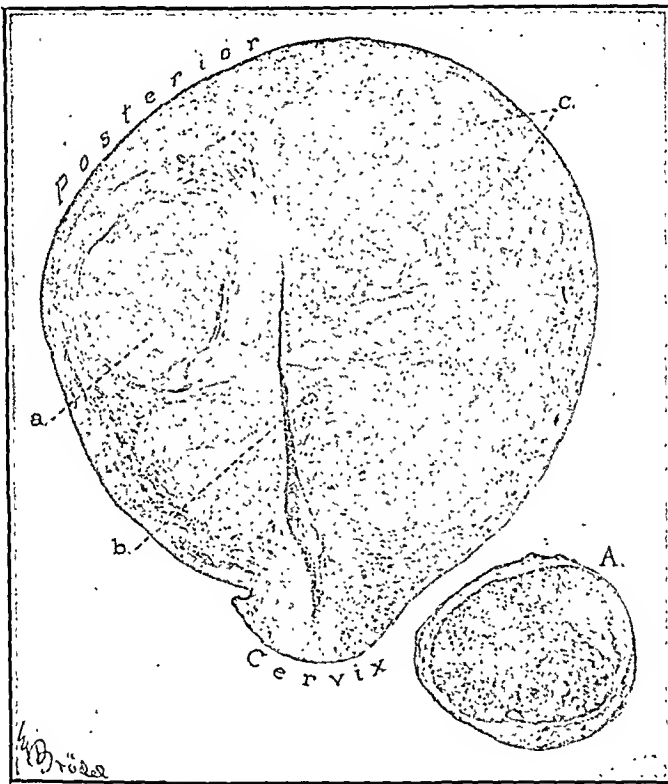


Fig. 1.—Adenomyoma of the uterus; *a*, intramural fibromyoma. *b*, endometrial cyst; *c*, caseous material, tuberculous, in the adenomyomatous areas; *A*, cystadenomyoma of the ovary filled with a caseous material.

period was associated with moderate pain. The patient was married but never pregnant. She had had two previous operations, one for a gangrenous appendix and one for a hernia. There was nothing in the past history or in the physical examination to suggest a tuberculous infection.

Since the onset of the present illness, one year previously, the patient had failed to menstruate one to two months in succession while at other times she had bled for fourteen or fifteen days. There had been a white vaginal discharge with some pain in the lower abdominal quadrants for one year.

On admission the temperature was 98.6° F., pulse 90, respiration 20, blood pressure 120/80, white blood cell count 9,300. The urine was negative except for a trace of albumin.

At operation there were encountered only a few adhesions and in the fundus of the uterus a tumor approximately the size of a cocoanut, which resembled a fibromyoma. The left ovary was cystic and contained a thick creamy material, smear and cultures from which showed no organisms. The right ovary was small and atrophic.

The uterus with 2 to 3 cm. of both tubes and the cyst of the left ovary were removed. The patient made an uneventful recovery and was discharged fifteen days after operation.

*Gross Pathologic Examination.*—The uterus measured 12 cm. from the cervix to the fundus and 11 cm. in its transverse diameter. The portion of cervix measured 1.5 cm. The uterus, except for some irregularities and a few fibrous adhesions, was relatively smooth. When the organ was sectioned in the anteroposterior plane, the uterine cavity was found to measure 6 cm. in length and at the internal os it had a diameter of 6 mm. which decreased in size as it approached the fundus. Surrounding the uterine cavity was a margin of spongy tissue 2 mm. in thickness. The cavity was compressed in its posterior part by a circumscribed, well-outlined

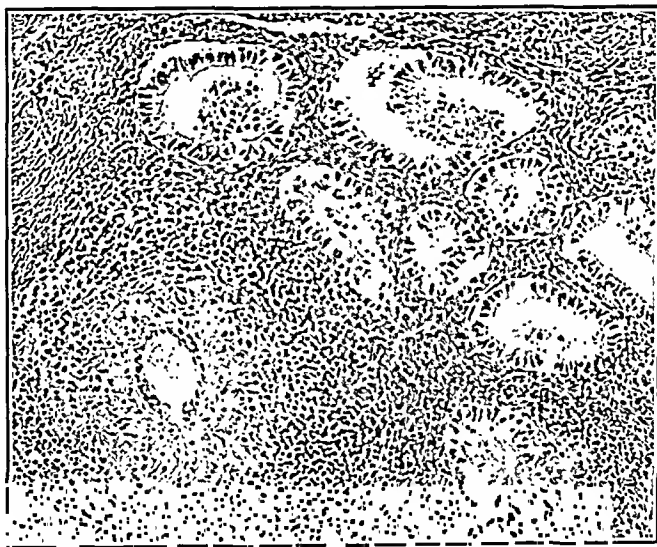


Fig. 2.—Photomicrograph of one of the adenomyomatous areas in the uterus showing the tuberculous infection.

tumor mass which produced a disproportion between the anterior and posterior halves, the former having a thickness of 5.5 cm., while the latter measured only 4 cm. This tumor, which measured 3.5 cm. by 2.5 cm., was composed of whorls of white fibrous tissue between some of which could be seen what appeared to be dilated blood vessels. The remaining cut surface of the uterus was composed of bands of white fibrous tissue of various sizes which passed in many directions. Between these bands of fibrous tissue were numerous irregularly shaped areas of caseous material. There were occasional cavities between groups of muscle fibers. At one point there was a small cyst, 5 to 6 mm. in diameter, which closely approached but apparently did not communicate with the uterine cavity. This cyst resembled somewhat a miniature uterine cavity.

The tubes were about 1 cm. in diameter, and on the surface showed a few fibrous adhesions.

The ovarian cyst was moderately soft in consistency and measured 4 cm. in its greatest diameter. The external surface was slightly irregular in contour due to a few fibrous adhesions. On section, the cyst was filled with a caseous material.

The wall varied from 1 to 5 mm. in thickness and showed dilated channels which resembled blood vessels.

*Histologic Examination.*—The diffuse enlargement of the uterus was due to fibromyomatous bundles of varying size. Throughout the section between the bundles of muscles one found gland-like structures of various sizes lined by columnar epithelium and surrounded by oval shaped cells resembling those found in the endometrium. In addition to the gland-like structures in the uterine wall, there were many epithelioid, mononuclear, and giant cells, tubercles, and areas of caseation. Carbol-fuchsin stain showed acid-fast bacilli. In one portion of the posterior wall of the uterus, there was a circumscribed tumor which had the characteristic appearance of a fibromyoma. In the fundus and adjacent to the uterine cavity, there were the most extensive tuberculous lesions in tissue which was definitely adenomyomatous in character. It was interesting to note that the tuberculous infection was situated around the glands in the endometrial stroma rather than in the myometrium. Much of the adenomyomatous tissue was replaced by caseous material. It was rare to find adenomyomatous areas without some form of a tuberculous reaction. The endometrium was the seat of an extensive tuberculous infection and in sections there was an extension of this endometrium for some distance up into the uterine wall.

The walls of both tubes were slightly thickened and contained gland-like structures which showed little or no cellular stroma around them. This was the condition found in salpingitis isthmica nodosa, and according to Sampson<sup>10</sup> in endometriosis of the tube, the epithelium here had a tubal origin. In the region of the mucosa in the tubes, there were many tubercles, giant cells, and epithelioid cells.

The ovary was converted into a cyst, the wall of which contained only a small amount of ovarian stroma. The greater portion of the wall was formed of hyaline fibrous tissue in which were numerous gland-like structures varying in size and resembling those found in the walls of the tubes. Foci of mononuclear and epithelioid cells were present in the wall. Because of the excessive amount of caseous material present, we were unable to determine the character of the epithelium which lined the cyst, and hence could not classify the cyst other than to say that it was one of the cystadenomas of the ovary.

#### DISCUSSION

It is often impossible to determine the primary focus of infection in cases of tuberculosis of the female genital tract, but usually the fallopian tubes are involved and by extension the infection reaches the remaining pelvic organs. We are under the impression that this occurred in our case.

Our case is of interest in that it tends to support Cullen's idea that adenomyoma arise from the uterine mucosa<sup>11</sup> and also in that it shows how the tuberculous infection reached the adenomyomatous areas, that is, by direct extension by way of endometrial tissue.

Mcneil has shown that many of the cases reported as "tuberculous ovarian tumors" are only tuberculous abscesses of the ovary. Such a conclusion as this might have been drawn from the gross findings at operation in our case, but upon histologic study, it is evident that we deal with a cystadenoma of the ovary associated intimately with a tuberculous infection.

A study of the literature on the subject shows that, with two exceptions, all cases of the combination of tuberculosis and adenomyoma of the uterus have occurred in women who were more than forty-two years of age and who were also sterile. The two exceptions occurred in women twenty and twenty-two years of age. A majority of the patients gave a history of some type of menstrual disturbance.

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## GRANULOMA OF THE VAGINAL VAULT

NATHAN P. SEARS, PH.B., M.D., SYRACUSE, N. Y.

A FAIRLY extensive search through the standard textbooks on gynecology as well as other sources of medical information fails to reveal a record of a case similar to the one to be described. For this reason the following case seems worthy of record.

Mrs. X., aged forty-six, consulted me on Oct. 10, 1931, for irregular vaginal bleeding which had been present for several weeks. Besides profuse and irregular menstruation there also was intermenstrual bleeding which appeared especially after intercourse. Her general health was always excellent and there had been no operations. Her menstruation began at the age of fifteen and was regular in every respect until her present illness. She had been married four years and had had no children. Two years after her marriage there was a delay of menstruation followed by profuse bleeding but no sign of pregnancy was found. She rarely took douches and there was no other source of trauma. There had never been any evidence of a venereal infection. She had been told by one physician that she should have radium treatment for her present condition and by another that a complete hysterectomy was necessary.

General examination was quite unimportant. Pelvic examination showed the uterus and adnexa to be normal. To the right of the cervix a soft velvety feel was noted. On withdrawing the examining finger, it was stained with blood. Rectovaginal examination revealed no thickening of the vaginal wall. The speculum disclosed in the right vaginal vault an irregular, granular elevated surface about 3 cm. in diameter extending for about 0.5 cm. upon the lateral aspect of the cervix. The structure of this lesion was composed of small red tufts of granular tissue, the surface was glistening, showed very little evidence of necrosis, but it bled easily when touched. The lesion resembled slightly an epithelioma, but showed no induration, and its surface was clearer and more glistening than the usual malignant lesion. Wassermann reaction was negative. The patient was sent to

the Syracuse Memorial Hospital where she was examined under anesthesia and the uterus curetted. The granular area was then thoroughly removed by the curette and all material saved for microscopic examination. The area left after removing



Fig. 1.—Magnification X54. Shows the form and general structure of an individual unit. The inflammatory reaction is seen near the surface (top of picture) and the connective tissue background at the base. Note the tortuous blood vessels throughout the entire section.

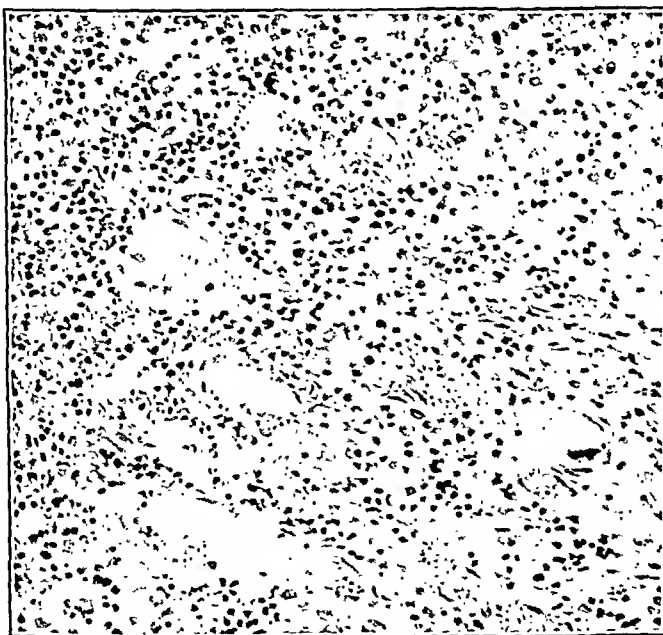


Fig. 2.—Magnification X230. Note the connective tissue background, the dilated capillaries and inflammatory cells.

the granuloma was flat and mottled with blood points. It was lightly sprayed with the coagulation current of the high frequency machine.

**Pathology Report:** Specimen consisted of about 2 c.c. of uterine mucosa of normal appearance, and about 1 c.c. of soft granular material from the vagina. The individual tufts of this were about 1.5 mm. in diameter, glistening, and congested. Blocks were made separately of the endometrium and the tissue from the vagina.

**Microscopic Examination:** The endometrium showed normal interval reaction. Under low magnification (Fig. 1) the section of vaginal tissue was seen to consist of roughly triangular pieces of tissue. It was evident that the narrower part of these provided the base by which they had been attached to the vaginal mucosa. Under slightly higher magnification (Fig. 2) the structure of each of these small triangular pieces of tissue was seen to consist of a fairly compact connective tissue stroma. In the outer third there were many inflammatory cells packed densely into the stroma, tortuous capillaries filled with blood, and considerable extravasation of red blood cells into the tissue. Toward the base, the inflammatory reaction gradually disappeared until it was found to be entirely absent in the proximal third. Here was seen wide bands of connective tissue and large tortuous vessels. Under still

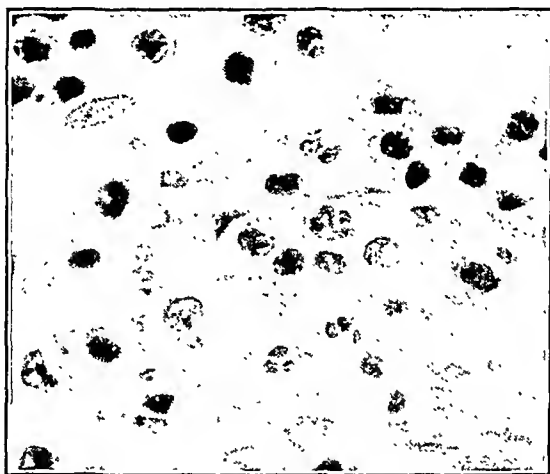


Fig. 3.—Magnification X1000. The types of cells are shown. Note the fibroblasts and plasma cells.

higher magnification (Fig. 3) the inflammatory cells are seen to consist of leucocytes, lymphocytes, eosinophiles, fibroblasts, swollen connective tissue cells and many plasma cells. The connective tissue bands were considerably broken up and separated by this reaction. The capillaries were filled with blood, and there were several areas in which many red blood cells were free in the tissue.

**Diagnosis:** Simple granuloma resembling granuloma pyogenicum.

**Further Treatment:** Patient returned to the office for weekly treatments. On November 12 and 19 the unipolar desiccation current was applied. Her next treatment was December 8. She was unable to return sooner because of a mild phlebitis in the calf of her right leg which appeared soon after the previous treatment. On this date the area was much smaller and desiccation was again applied. From then on the area gradually diminished and silver nitrate was applied at tri-weekly intervals. On January 17 the area was 3 mm. in diameter. On the twenty-eighth it was healed completely but bled when touched. On February 7 the patient was discharged healed and has had no recurrence. There have been two profuse menstrual periods, apparently due to menopause dysfunction.

## DISCUSSION

The case presents the characteristics of a simple granuloma. Histologically it resembles the so-called *granuloma pyogenicum*, so often found on the skin and mucous membrane of the mouth. It differs, however, in that the pyogenic granuloma is usually a pedunculated or sessile tumor. So far as I have been able to find there is no previous report of such a lesion in the vagina.

505 MEDICAL ARTS BUILDING.

## A MODIFICATION OF THE FRIEDMAN PREGNANCY TEST

MORTON VESELL, M.D., NEW YORK, N. Y.

THE proposed modification of the Friedman test is based upon an experience in 883 cases, in some of which the original Asehheim-Zondek test was employed and in others, the original Friedman method. The percentage of accuracy attained with the Asehheim-Zondek test was 99.2 per cent in my hands, with the Friedman test 89 per cent. While the Asehheim-Zondek test has an accuracy approaching the 100 per cent ideal, it nevertheless, has certain disadvantages which were avoided in the Friedman modification. It was, therefore, deemed desirable to attempt to modify, if possible, the technique still further and try to approach an ideal.

The technique adopted is as follows:

1. The first morning specimen of urine is used. Urines may be kept, when necessary, for varied lengths of time. (One specimen of urine gave a positive reaction after being kept in the ice box for one year.)

2. The ear vein of the rabbit is dilated with ether and 7 c.c. of the first morning urine is injected intravenously. The marginal vein is preferred as it is the most fixed.

3. Any female rabbit, weighing not less than 1600 gm., irrespective of its maturity has been employed as test object. However, virgin rabbits are preferred. The picture of the ovaries of mature and even of pregnant rabbits after injection with urine of nonpregnant and of pregnant women is so easily differentiated that it makes very little difference to the experienced technician as to the type of animal used. The effect of the urine of pregnant women upon the ovaries of mature nonpregnant rabbits, as well as upon the ovaries of pregnant rabbits, may be described as superovulation. Animals weighing less than 1600 gm. should not be used as they may be too young to react to the hormonal stimulation.

4. The injection is given very slowly with a 10 c.c. syringe and ordinary hypo needle at the rate of 1 c.c. per minute. (Should the animal show any untoward reactions, the intravenous injection of 1 c.c. of eoramine is administered. This drug has actually saved a number of rabbits that surely would have died.)

5. The animal is operated upon or killed by the intravenous injection of air at the end of forty-eight hours and the ovaries examined. The injection of 10 to 40 c.c. of air is quickly effective. This procedure was found more satisfactory than gas, ether, chloroform or the rabbit blow which were used in the early tests.

6. A positive result, indicating pregnancy, is judged solely by the presence of



corpora hemorrhagica. This finding is pathognomonic for the presence of the hormone in the urine of pregnancy and cannot be mistaken for the changes in the ovary occurring in a spontaneous pregnancy in the test animal.

7. Gross examination sufficed in 100 per cent of the cases. There are no doubtful cases, the results being either distinctly positive or negative.

The above procedure is used routinely in all cases where the amenorrhea has exceeded ten days and differs from the original Friedman test as follows: (1) 7 c.c. instead of 5 c.c. of urine is injected. (2) Autopsy is performed in forty-eight hours instead of twenty-four hours. (3) Female rabbits of any size, weighing at least 1600 gm. instead of virgin rabbits may be used.

The majority of errors occur in cases of amenorrhea of ten days' duration or less. For this group of patients the method has been further modified as follows: (1) The initial injection is given exactly as above. (2) The same rabbit is reinjected with 7 c.c. of the same urine, twenty-four hours after the first injection. The urine is kept in the ice box between injections. (3) Autopsy is performed forty-eight hours after the initial injection.

This variation in procedure, in cases of very early amenorrhea, has enabled me to eliminate the errors encountered in earlier experience. Ninety per cent of the errors with the original Friedman test, in my series, were in cases of amenorrhea of less than ten days.

#### DIAGNOSIS OF DEATH OF THE FETUS

The Aschheim-Zondek test and all its modifications have also been used in diagnosing the death of a fetus. In this respect the various tests have given rather disappointing results. Most observers have reported that the Friedman test becomes negative within seven to fourteen days after the death of the fetus. Nevertheless, in this present series of cases a positive result has been obtained as late as the sixth week after the death of the fetus. The time it takes for the urine to become negative after the fetus dies appears to depend somewhat on the stage of gestation. Observations upon this point, in my series, may be summarized as follows:

1. When a Friedman test proves negative in a case of previously proved pregnancy, it indicates fetal death.

2. When the clinical signs indicate fetal death and the second Friedman test is still positive, the latter does not necessarily contradict the clinical diagnosis because the fetus may be dead and the chorionic elements may still retain their viability. This can persist for from four to six weeks after the death of the fetus and has been borne out by cases in which a second positive test was reported twenty-four hours before the patient was delivered spontaneously of a six months old, macerated fetus.

3. In ectopic pregnancy, positive results have been recorded up to three and a half weeks after the onset of vaginal bleeding and in several cases where there was only slight spotting, up to four weeks after the initial day of spotting. This

necessarily involves the acceptance of the theory that vaginal bleeding is a sign of death of the fetus in cases of ectopic pregnancy.

4. In this series, where the pregnancy reached the period of viability and subsequently the fetus died, the test remained positive for a longer period than two weeks. All cases of incomplete abortion and full-term pregnancy, in this series, gave negative results within two weeks after the clinically suspected termination of the gestation.

#### SUMMARY AND CONCLUSION

1. The Aschheim-Zondek test and its modifications have been carried out in 883 cases. In the total there was an accuracy of 98 per cent. The original Aschheim-Zondek test performed with mice, in 250 cases, showed an accuracy of 99.2 per cent. The Friedman test carried out in 100 cases, with rabbits, gave 89 per cent accurate results. The present modification, adopted in the last 533 cases, of this series, showed 100 per cent accuracy.

2. A positive result has been obtained after the death of a fetus for a period of four to six weeks in gestations of six months' duration or more.

302 WEST NINETIETH STREET.

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### PREGNANCY AND LABOR SUBSEQUENT TO ABRUPTIO PLACENTAE AND UTEROPLACENTAL APOPLEXY\*.

SAMUEL S. ROSENFELD, M.D., F.A.C.S., NEW YORK, N. Y.

WHILE the textbooks and most of the papers on the subject go quite thoroughly into the matter of immediate prognosis, practically none of them as much as mention future prognosis. Of the standard obstetric textbooks that I have consulted only DeLee touches on the question of recurrence of abruptio placentae and he says, "Abruptio may recur in subsequent labors." Two of the largest and most widely known obstetric institutions in the country could furnish me with no statistics on the matter of recurrence. There is also a marked lack of data as to the future of patients who have had abruptio. This paper is an attempt to build up a statistical structure so that these important prognostic questions may be answered.

Within the last five years, I have personally treated fifteen patients with abruptio placentae. All of these cases could be classified as severe. Seven of these women were primiparas, five were secundiparas, one was a tertipara, one a quadripara and one of unknown parity. Five cases were of the extreme type of abruptio, namely uteroplacental apoplexy.

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\*Read before the New York Academy of Medicine, Section on Obstetrics and Gynecology, May 24, 1932.

In my series of 15 cases, the apparent causes of abruptio placentae were toxemia in 12, infection in one, profound mental emotion in one, and in the remaining one no cause could be ascertained or assigned. Uteroplacental apoplexy occurred five times. Eclampsia was present once. In this series there were 15 patients with one recurrence making 16 cases of abruptio placentae in all. Of these, 7 patients delivered spontaneously. I delivered one by low forceps, one by internal podalic version and breech extraction, 2 by breech extraction and 5 by cesarean section. In 2 patients, I introduced bags and both delivered spontaneously. I encountered the Couvelaire type of uterus 5 times.

Of these 15 women, I have subsequently delivered 5. The histories of these 5 cases are as follows:

E. R., aged twenty-four, para ii. One year ago she had a premature separation of the placenta at full term, and was told, by her family doctor at the time, that she had kidney trouble. I was called in consultation and with conservative treatment she was delivered of a stillborn infant. She made a good recovery. She became pregnant shortly afterwards, was on a diet that contained very little protein and showed no evidence of toxemia, such as rise in blood pressure or albumin in the urine until about two weeks before term. Her pressure then rose moderately and small amounts of albumin appeared in the urine. On the day of admission to the hospital she began to bleed and had abdominal pain of moderate severity. Her condition was fair. The fetal heart could not be heard. The uterus was board-like, the cervix was two fingers' dilated, and the membranes were intact. I decided to treat her conservatively. I ruptured her membranes, packed her, and gave small doses of pituitrin. The bleeding, however, continued and her condition grew worse. I therefore transfused her and performed a trans-peritoneal extraperitoneal cesarean section under local infiltration anesthesia. The uterus presented the typical picture described by Couvelaire as uteroplacental apoplexy. The fetus was dead. The placenta was lying loose and the uterine cavity was filled with blood clots. The uterus contracted in a satisfactory manner and I therefore closed the uterine and abdominal incisions. Her convalescence was marked by the development of a pelvic abscess, which was opened and drained per vaginam. She left the hospital in good condition.

R. E., para ii, aged twenty-seven. Her previous labor four years ago was complicated by abruptio and eclampsia. Her present pregnancy was uneventful except for some staining or very scant bleeding early in her pregnancy. This subsided after rest in bed and calcium therapy. Blood pressure, urine and blood chemistry determinations were normal throughout the pregnancy and the puerperium. She was delivered spontaneously of a living baby.

S. H., para ii, aged twenty-five. Five years previously I performed a cesarean section on this patient because of a very grave form of abruptio placentae. The uterus was an extreme example of the Couvelaire type. Her intervening history was irrelevant except for an obstinate peripheral neuritis. Her pregnancy was uneventful, the urine and blood pressure were normal throughout. I delivered her of a living child by classical cesarean section. She made an uneventful recovery.

R. W., para ii, twenty-four years old. I had performed a classical cesarean section under local anesthesia on this patient two years previously, because of

abruptio placentae and toxemia of pregnancy, as evidenced by a blood pressure of 190/100, four plus albumin, and granular casts in the urine. In addition there was present an atresia of the vagina and cervix making vaginal delivery impossible. Two years later, I did a classical cesarean section under general anesthesia. I performed this operation before the onset of labor. On opening the peritoneal cavity, I found a hole in the uterus about the size of a silver half dollar near the fundal end which was plugged by the amniotic sac. The uterine muscle about this area was very thin and stretched. I delivered a normal living infant and sterilized her. She made an uneventful recovery. During this pregnancy her blood pressure and urine were normal.

C. G., para ii, aged twenty-three. During her previous pregnancy at about term she developed a toxemia of pregnancy and a moderately severe form of abruptio placentae. I ruptured her membranes and introduced a bag into the cervix and she was delivered spontaneously of a stillborn child. One year later, I delivered her normally of a normal living infant. Her urine and blood pressure were normal throughout pregnancy. She is pregnant again.

I tried in this series of cases to employ the conservative plan of treatment wherever possible. This consisted in an initial dose of morphine, artificial rupture of the membranes, tight vaginal packing, and hypodermic injections of small doses of pituitrin when the labor pains were weak, or absent.

My practice now in the grave cases is to transfuse and then perform cesarean section under local infiltration anesthesia. In cases of uteroplacental apoplexy, Polak favored cesarean section followed by hysterectomy. As stated above I have had five cases of proved uteroplacental apoplexy. I have subsequently delivered two of these women of normal living infants by classical cesarean section.

In the treatment of the Couvelaire type of uterus, it seems to me that in the majority of cases, hysterectomy would be too radical a procedure. I believe that in such cases, the uterus should be watched for a minute or two and if it shows contractile power it should be saved. The uterine muscle is apparently damaged however and in subsequent labors, those women who were treated by cesarean section should again be similarly treated, preferably before the onset of labor.

Pregnancy was observed in five patients in this series after abruptio placentae. Four of these women had an uneventful pregnancy and labor and gave birth to living children. In one patient abruptio placentae recurred, and she was delivered of a stillborn fetus.

A woman having abruptio placentae need not necessarily be advised to avoid pregnancy for her chances of having a normal pregnancy and labor are good.

## REPORT OF A CASE OF RUPTURED OVARIAN CYST IN THE NEWBORN\*

SAMUEL M. DODEK, M.D., M.A., WASHINGTON, D. C.

**E**ARLY in the morning of Dec. 11, 1931, Mrs. S. H., a white Polish woman aged twenty-eight, was admitted in active labor at term, to the Obstetrical Division of the Cleveland City Hospital for care. She had had four previous pregnancies, each spontaneous and uneventful at full term.

Labor began at 2:00 A.M. of the day of admission and full dilatation of the cervix was attained at 5:30 A.M., the membranes having ruptured at 4:30. After the patient was scrubbed for delivery, the fetal heart was 144 and the fetus was presenting in the persistent right occipitoposterior position, at a low midpelvic plane. I rotated it to an anterior position by the modified Scanzoni maneuver of Bill. Reapplication of the forceps followed at once, and extraction was attempted.

The head was delivered with very little difficulty, but difficulty was encountered when an attempt was made to deliver the anterior shoulder under the symphysis pubis. Gentle, but firm, traction on the head with additional aid received from pressure on the fundus by an assistant, were of no avail. Since the patient had a markedly relaxed pelvic floor it was not difficult to insert the hand into the birth canal along the anterior surface of the baby's chest, partially extend the anterior forearm and manually extract that member. The shoulder then followed easily. Dorsal traction on the fetus effected the delivery of the posterior shoulder over the perineum and the arm and forearm were extracted with a fair amount of ease.

After the bisacromial diameter had passed the vaginal outlet, difficulty was again experienced when an attempt was made to extract the trunk. Again with pressure on the fundus and with traction from below, a fullterm baby girl weighing 3,850 gm., with marked abdominal ascites, was delivered at 6:14 A.M., forty-four minutes after the onset of second stage labor. The baby breathed at delayed intervals for one hour, but all attempts at resuscitation and stimulation failed to keep it alive.

The third stage of labor was terminated quickly and the mother was returned to her own bed in good condition, suffering from no visible new lacerations of an already relaxed perineum. On the eleventh day postpartum she was discharged.

A postmortem examination of the infant was done five hours after death.

Externally the thorax was symmetrical and when that cavity was opened (which procedure followed opening the abdomen) the lungs were found to be filled with air and they did not collapse. No fluid was found in either pleural cavity and the pericardium was smooth and the heart small.

The abdomen was markedly distended and tense, and dull all over to percussion. On opening the abdomen a large amount of hemorrhagic material was found in the peritoneal cavity. The dome of the diaphragm was at the third rib on the right and the fourth on the left. The lower border of the liver extended 1 cm. below the free costal margin in the right midclavicular line. The gall bladder and intestines, which were displaced to the left and upward by a mass extending into the abdominal cavity from the pelvis, appeared normal. No gross changes could be demonstrated in the spleen, adrenals or urinary system.

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\*Presented before the Obstetrical and Gynecological Section of the Academy of Medicine of Cleveland, May 11, 1932.

The uterus was normal, measuring 2 cm. in length. The left tube and ovary presented no abnormalities and the right tube, too, seemed normal. The broad ligaments were also normal. However, occupying the site of the right ovary was a cyst (Fig. 1) measuring 12 cm. in diameter which occupied the major portion of the abdomen.

The surface of the cyst was smooth and at the upper border there was an irregular linear tear measuring 3 cm. The contents were made up of bloody material estimated at 300 c.c. (including that which had escaped into the peritoneal cavity through the tear) and when the contents were removed the inner surface appeared covered by a layer of fibrin. The wall was thick at the base, the site of the original ovary, but very thin in the region of the tear.

A histologic examination was made by Doctor David Seecef, Director of Laboratories in the Cleveland City Hospital.

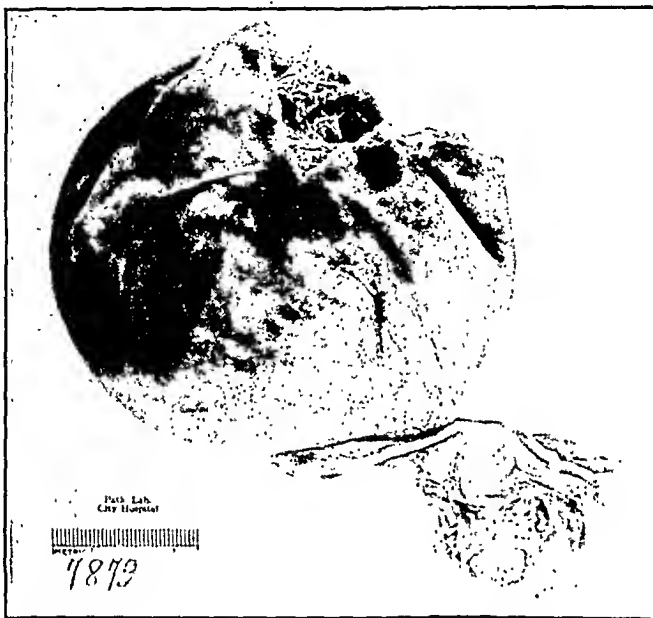


Fig. 1.—A photograph of the gross specimen showing the uterus, adnexa, and the cyst replacing the right ovary.

Fig. 2, a low-power microphotograph of the base of the cyst demonstrates at one end, a narrow zone of compressed ovarian tissue containing a moderate number of ova (Fig. 3). The remainder of this section is made up of a scantily cellular and stringy fibrous tissue lined internally by a well-defined layer of flattened and elongated endothelial-like cells containing a few scattered lymphocytes.

The diagnosis was made of follicular cyst of the right ovary.

The left ovary was normal except for edema of the interstitial tissue.

Other reports of ovarian cysts including simple cysts, sarcomas, and carcinomas occurring in young children, in the fullterm newborn and in the premature infant, have appeared from time to time in the literature which is available for investigation; but the case presented here as far as I can determine, is the largest on record for a fullterm newborn baby and the only one which I have been able to find which was the cause of dystocia and very early neonatal death.

Kelly<sup>1</sup> in 1889 tabulated 126 cases of benign and malignant tumors of the ovaries in young females, which had been operated upon. The youngest, a patient of D'Arcy Powers,<sup>2</sup> was four months old.

Included in the Transactions of the Pathological Society of London for 1889, is a report by Alan Doran<sup>3</sup> of the finding of bilateral ovarian cysts in a seven-month fetus.

In 1891, Beale of England<sup>4</sup> reported the autopsy findings of a six-week-old infant which died four days after the onset of symptoms of peritonitis. A purulent fluid was found in the peritoneal cavity and the pelvis was filled with pus. Attached to the right ovary were the remains of "a small ruptured cyst."

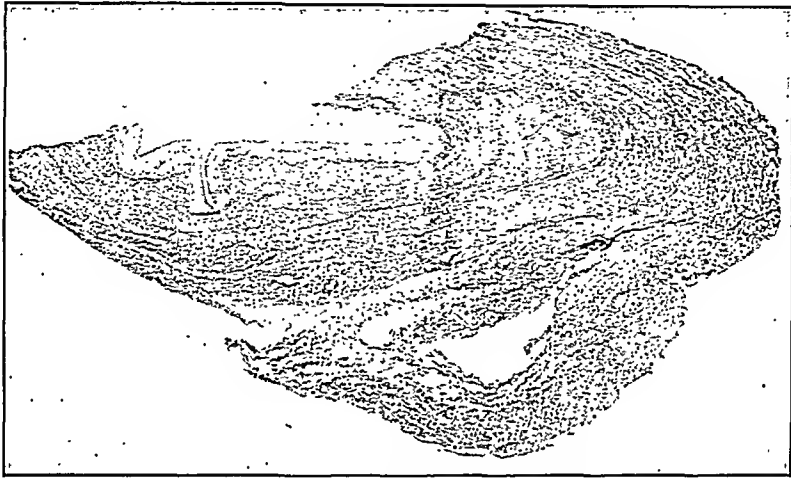


Fig. 2.—Low-power microphotograph of the base of the cyst showing, at the right border, the remains of the ovary and the inner layer of the sac.



Fig. 3.—The remaining ovarian tissue, containing several ova.

W. A. Downes<sup>5</sup> in 1921 reported a case in which a swelling of the abdomen was noted at birth. The distention gradually increased until at the age of seven months, when the infant was seen by Downes, a diagnosis of ovarian cyst was made and a simple cyst successfully removed. It is Downes' impression that these tumors may reach a considerable size in the fetus and that the earlier they make their appearance, the better the chances are that the growth is benign rather than malignant.

A right ovarian cyst which became twisted and strangulated the body of the uterus and left tube and ovary, necessitating entire removal of all the internal

genitalia, was reported by E. M. Powell<sup>6</sup> in 1923, in a five-month-old infant. The operative result was said to be good.

V. Franque,<sup>7</sup> 1909, reported a pedunculated unilocular cyst of the left ovary, which he discovered during the postmortem examination of an infant which died eighteen hours after birth. The cyst was round (4 cm. in diameter), intact, and its pedicle was twisted three times on itself. Microscopic examination of the specimen revealed some ovarian parenchyma, and he called it a cyst of a graafian follicle. The right ovary in the same subject contained a small cyst the size of a pea.

One of the most recent contributions to this subject is by H. O. Neuman<sup>8</sup> of Germany. During a postmortem examination to determine the cause of death of a fetus which occurred eighteen hours before the onset of the second stage in a primiparous labor, he discovered a right ovarian cyst somewhat similar, macroscopically, to the one reported in this paper. His specimen was smaller, however, measuring 10 by 9 by 8 cm., and was unruptured. The suspensory ligament on the side involved was absent and there were no cystic changes in the opposite ovary. Microscopic examination showed connective tissue and numerous blood vessels near the lumen of the cyst but no evidence of ovarian tissue was seen. Neuman believed that the parenchyma of the original ovary was possibly destroyed by the rapidly enlarging tumor, and that the stroma had been so markedly disintegrated that it could not be recognized as such. For these reasons he ventured no classification of his specimen.

H. A. Harris<sup>9</sup> about two years ago, described two multilocular cysts of the ovary found during a routine postmortem examination of a two-month-old infant which had died of bronchopneumonia.

#### DISCUSSION

Justification for the presentation of this single case report lies, I believe, in the facts that this condition is not usual; that this particular cyst was larger than any hitherto reported, and that it was sufficiently large to cause a moderate dystocia. Death of the infant was due to rupture of the cyst, and associated internal hemorrhage brought about by the disproportion encountered during delivery of the infant's trunk.

I desire to express my appreciation to Dr. A. H. Bill, of Cleveland, for permission to report this case.

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1835 EYE STREET, N. W.



# THE TREATMENT OF ASPHYXIA IN THE NEWBORN BY LUNG INFLATOR FOR INDIRECT MOUTH-TO-MOUTH BREATHING

PIERCE MACKENZIE, M.D., EVANSVILLE, IND.

THE essential care of the newborn baby that does not breathe spontaneously after the air passages are cleaned out as well as possible with a catheter, is to maintain the body temperature by putting the child into warm water and to inflate the lungs with expired air which contains oxygen and also carbon dioxide.

This inflation may be accomplished by means of a catheter in the trachea as recommended by DeLee; by means of apparatus such as devised by Henderson, Flagg or Kreiselman which delivers oxygen or a mixture of oxygen and 5 to 10 per cent carbon dioxide from a tank; or by mouth-to-mouth breathing.

The tracheal catheter has proved satisfactory to many but there is a considerable amount of skill necessary in introducing the catheter into the trachea with a possibility of injury to the throat by rough examinations; especially is this true in the premature newborn of seven to eight months' gestation. There is the necessity of repeated introductions of the catheter when the air passages contain mucus or blood which must be removed from time to time and there must be a careful estimation of the amount of air pressure used so that no damage be done to the lung cells.

The various apparatus on the market are expensive, not easily transported when deliveries are made in different places, and they or the gas tanks are frequently out of order on the surprise occasion.

Direct mouth-to-mouth breathing, although successful from early history, is not easy to establish and is dangerous to the infant's lungs because of the indefiniteness of the pressure applied. It is very disagreeable and also dangerous to the obstetrician because of the possibility of infection.

Expired air offers a logical stimulus to respiration as it contains both oxygen and carbon dioxide in considerable amounts. Howell gives the percentage of oxygen between 11 and 17 per cent and carbon dioxide between 3.7 and 5.5 per cent. I believe it is practically as efficient as the gases supplied from tanks.

I have found that at times ammonia acts as a definite respiratory and cardiac stimulant. Too much must not be used as it may produce edema of the mucous membrane by irritation.

I have devised an apparatus whereby mouth-to-mouth breathing may be carried on with no intimate contacts, with a definite control of pressure to the baby's lungs and with the possibility of using ammonia at the same time if desired. If the combination of gases obtainable in tanks is thought advantageous, the face mask of this apparatus, without the breathing tube, may be attached to a standard gas machine breathing tube having such a tank, and the gas administered as recommended by Henderson. I have found the mouth breathing method as here described satisfactory.

The apparatus may easily be carried in the physician's bag or pocket and is inexpensive. It can easily be at hand anywhere when needed when the baby is born in poor condition due to the injudicious use of morphine or pituitrin during labor, or after a delivery with a general anesthetic, after cesarean section, or when due to an accident to the fetus' circulation during normal or prolonged labor the baby is born unable to breathe spontaneously.

The apparatus consists of a rubber mask to fit a newborn's face, a mouthpiece and tube for the doctor to breathe into, a spring gauge with indicator to control the pressure of the air delivered to the child's lungs and a container for aromatic spirits of ammonia on cotton which may be opened into the air passageway. The breathing tube may be detached from the mask to allow attachment to a standard gas machine for oxygen or a mixture of oxygen and carbon dioxide from a tank if desired.

All fluid, blood and mucus are removed from the baby's mouth and nostrils as soon as the head is born. The nose and throat are sucked free of fluid by a catheter with the child's head held down, and if the asphyxia is of the serious type, the child is placed in a water-bath at the proper temperature. The doctor himself or a nurse supports the baby's shoulders and head so the neck is straight, and the mask is placed to cover the baby's nose and mouth. The breath is

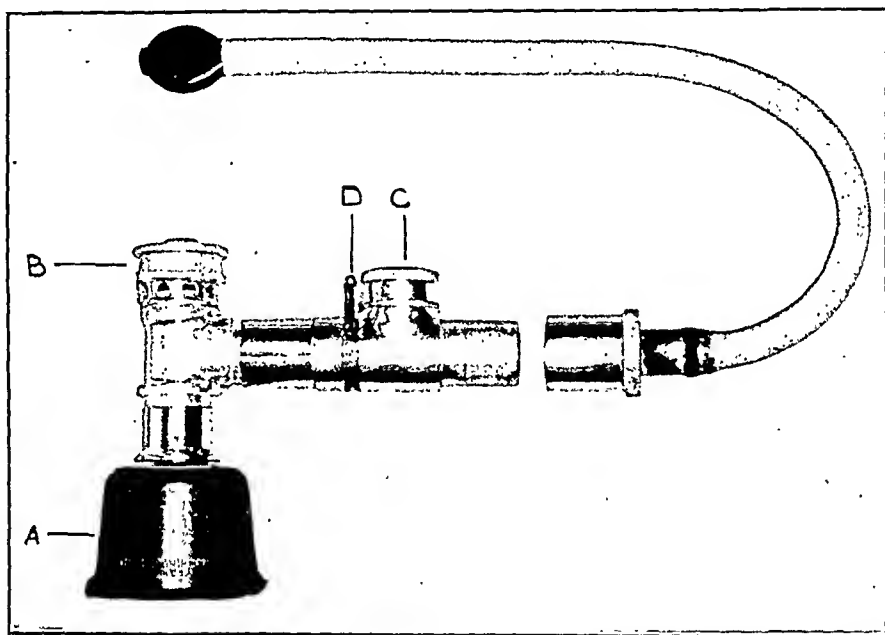


Fig. 1.—Lung inflator. A, Special infant size rubber mask; B, adjustable gauge for pressures delivered; C, cup for aromatic spirits of ammonia; D, cutoff for ammonia into airway.

exhaled in puffs through the mouthpiece at the rate of about thirty to forty per minute with the spring set at the proper mark to blow off at more than one one-hundredth of one atmosphere or about 6 or 8 mm. mercury pressure. Slightly more pressure may be found better. This is readily obtained by adjusting the spring gauge. The throat is kept clear of fluid by the catheter as needed. The baby's heart action is watched by observing the pulsation at the navel or neck. Ammonia may be let into the airway by opening the cutoff as desired. If prolonged efforts are necessary, the baby's tongue is best pulled forward by putting a suture through the tip of the tongue and traction is made on the suture by pulling it under the edge of the mask. This opens a more direct, unobstructed passage into the trachea.

A few drops of pituitrin or suprarenalin hypodermatically may be used to stimulate the circulation.

I have observed temporary stimulation of respiration by alpha-lobelin, but I do not consider it sufficient in itself in severe asphyxias.

AMERICAN TRUST BUILDING.

# TRUE SARCOMATOUS CHANGE IN A UTERINE FIBROID,

PAUL D. SCOFIELD, M.D., COLUMBUS, OHIO

THE question of malignant change of leiomyomas of the uterus is still somewhat misunderstood. For a good many years gynecologists and surgical pathologists have been searching through wide areas of benign tumors, and on finding suspicious foci they have tabulated these as sarcomatous changes, thus multiplying the number of cases of malignancy. It can be shown that many such foci are not of clinical interest because they do not represent the beginning of a true malignancy, but rather an acceleration of growth which is often temporary in nature. However, the following case represents an instance of true malignancy in a uterine fibroid. Its presentation is warranted not only because of its comparative rarity, but also because it should teach us to attempt to correlate the histologic picture with the management of the case.

Patient, aged forty-five, first seen May 13, 1930 complaining of lower left abdominal pain and vaginal bleeding. These symptoms began four months before and were constant. Bleeding varied from a scanty to a profuse amount. Pain was dull and aching, radiating to the left hip. During the previous two months she had a sensation of fullness in her abdomen and thought that it had increased in size. She was admitted to the hospital May 14, 1930. Urine and blood were normal. The hemoglobin was 85 per cent. Family history was negative for malignancy. Her general condition was good. The physical examination was negative except for abdomen. There was tenderness and some rigidity in the lower left quadrant. There was a palpable symmetrical mass about the size of a four months pregnant uterus. The vaginal examination confirmed the above.

The patient was operated upon May 15, 1930. Under ether anesthesia a midline incision was made exposing a uterus enlarged to the size of a grapefruit, containing many fibroids; it was rotated to the right, upon the cervix, with a resulting chronic inflammation of the left tube and atrophy of the ovary. A routine panhysterectomy, left salpingo-oophorectomy, and appendectomy were done. The pathologic report was as follows: "Uterus measures 10 cm. very much distorted by fibroid growths. One measures 4.5 cm. in diameter, filling the body of the uterus, with several smaller ones in the wall, and a larger growth at one side, about 7.5 cm. in diameter which is rather friable. On section the center appears to be undergoing a degenerating process with the surface markedly roughened. Microscopic diagnosis: *Leiomyomata undergoing sarcomatous change*. Chronic salpingitis, sclerotic ovary, chronic appendicitis." Convalescence was uneventful and the patient left the hospital on the twenty-sixth day after operation.

Patient was not seen again until May 2, 1931. At this time she complained of severe pain in the right hip. X-ray of the pelvis showed a "moth-eaten appearance of horizontal ramus of right pubic bone, resembling malignancy." Physical examination was negative, except for a hard mass in the old incision about the size of a half dollar. Patient stated that she became lame on February 25, and was compelled to go to bed April 10 because of the severe pain which was constant in the region of the right hip. On admission to the hospital, the urine contained 100 mg. of albumin with hyaline casts. Two days later it was negative. Blood count was normal, and the hemoglobin was 90 per cent.

Biopsy was decided upon and on May 4, an incision was made through the old scar and over the mass. This latter was found to be larger than suspected and

involved not only the abdominal wall, but also the fascia and peritoneum. The peritoneal cavity was opened and the entire pelvis and lower abdomen was found to be the seat of a sarcomatosis. The pathologic report was "spindle-cell sarcoma." The patient became progressively weaker and died June 21, 1931.

The essential feature of the autopsy was the confirmation of the operative findings. The lower abdomen and pelvis were filled with leiomyomatous nodules, whose microscopic appearance was exactly the same as that of the original tumor.

We have in this case the recurrence of a uterine fibroid and its fatal termination. Malignancy in this type of tumor is of two kinds: (1) Recurrence and overgrowth because the primary tumor was actively growing and of such a nature as to be difficult of removal. In this type apparently some of the growth is left behind. No difficulties were encountered in this particular case, however, in the removal of the growth. Hence it falls into the second class, (2) true malignancy. In this latter type there is always some variation from the ordinary fibroid in the histologic structure, although these variations, as in this case, are not marked. It is the occasional occurrence of the suspicious foci in uterine fibroids that make it decidedly worth while to carefully watch the character of the apparently degenerative changes and study them for possible malignancies.

283 EAST STATE STREET.

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## A SIMPLE PROCEDURE OF ASCERTAINING THE SEX OF THE NEWBORN, WHERE THE DIAGNOSIS IS DIFFICULT DUE TO GENITAL ABNORMALITIES

J. THORNWELL WITHERSPOON, M.A., OXON., M.D., NEW ORLEANS, LA.

UNFORTUNATELY the laity places a stigma, amounting almost to disgrace, upon any condition resembling half male and half female, and naturally enough this form of pseudohermaphroditism is the first thought that the layman has when he learns that the sex of his neighbor's child is uncertain. No mother wants it known among her friends that the sex of her long awaited baby is doubtful; nor would any mother enjoy having to tell her friends that her newly arrived son had turned out to be a daughter.

The solution to this distressing and embarrassing problem lies in the doctor's ability to make an immediate and correct diagnosis of the sex of the baby at the time of delivery, and thereby keep within the family circle the knowledge of any congenital sexual abnormality. But such accurate diagnosis is not always easy, and the very simple procedure of catheterizing whatever genital orifice that presents itself is offered as an additional aid in the determination of the true sex. If urine is obtained by this maneuver, the orifice is undoubtedly the urethra, and the child can be safely called a male. However, if urine is not immediately obtained, not even after a second catheterization, or if urine escapes around the base of the catheter, the child can be correctly diagnosed a female, since the orifice must lead into the vagina. However, in spite of all methods of examination, some cases are encountered in which abdominal operation is the only means whereby the true sex of the infant can be determined.

At a recent delivery the baby's genitalia, Fig. 1, presented a small orifice at the base of an organ that could have been an abnormal penis or an enlarged clitoris. The perineal raphe extended posteriorly from this orifice, bisecting two folds of tissue that resembled the labia majora; no testicle could be palpated in

either fold. An immediate determination of the sex of this baby was impossible by the usual methods of examination, since the condition could have been either a marked hypospadias, with bilateral undescended testicles, or a partially imperforated vagina with an enlarged clitoris.

Five doctors in all saw this condition before any internal examination was made; three diagnosed the baby as female, two as male. The child was then taken to a hospital and cystoscoped, and the orifice between the labia majora-like structures was found to be the urethra, not the vagina; in consequence, the condition was diagnosed as a case of marked hypospadias, with bilateral undescended testicles and the baby was pronounced to be of the male sex.

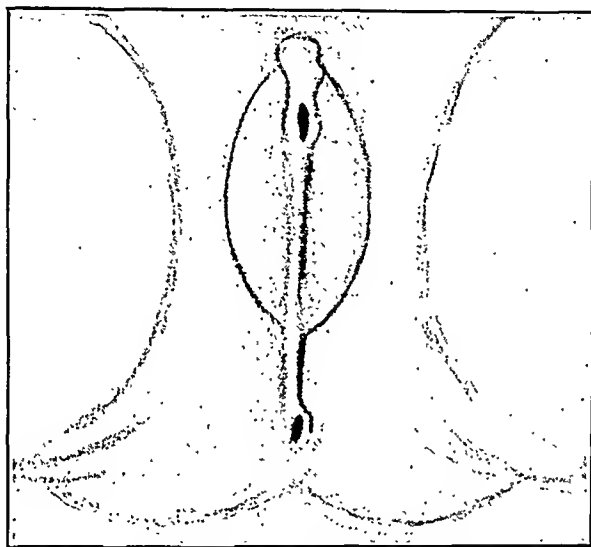


Fig. 1.—Appearance of genitalia at time of delivery.

Upon relating this case to Dr. Isidore Cohn of New Orleans he asked why no catheter had been inserted into the genital orifice at the time of delivery. The answer was simple; it had not been thought of. Realizing, however, that cystoscoping the orifice was very similar to catheterizing the same orifice, permission was obtained from the mother to insert a catheter and immediately urine was obtained. Had this examination been made at the time of delivery, the family would have been saved the very unpleasant and embarrassing situation in which they were placed.

This very simple, but accurate diagnostic procedure of catheterizing whatever orifice that presents itself in abnormal genital formations of the newborn is offered in order to ascertain immediately, when the usual methods of examination fail, the true sex of the child.

1640 ARABELLA STREET.

## THE UMBILICAL CORD RELATIVELY SHORTENED BY COILING ABOUT THE NECK OF THE FETUS\*

ABNER ZEEM, M.D., SCHOFIELD BARRACKS, T. H.

MANY cases have been reported in the literature upon this subject. However the occurrence of four or more coils of cord about the neck of the fetus is rare. McCaffrey,<sup>1</sup> in his series of 3,000 cases, found three cases with the cord about the neck four times. In his series, there were no cases with more than four loops of cord about the neck. Konikow<sup>2</sup> considered one case with a cord 97 cm. in length and coiled about the neck of the infant three times of sufficient interest to report it. Gossett<sup>3</sup> reported a case with five coils of the umbilical cord about the neck of the fetus. Edgar is mentioned as having had a case with the cord wound seven times about the neck causing death of the fetus. There are many more cases reported but the incidence of breech presentations reported is rare. For this reason, I feel justified in reporting a case delivered by breech extraction with a cord 120 cm. in length coiled about the neck of the fetus six times.

Mrs. O. M., multipara in her third pregnancy reported to the prenatal clinic of the Station Hospital, Schofield Barracks, T.H., for observation and treatment at the end of her sixth month of pregnancy. Blood pressure readings and urine specimens were all negative during her prenatal period. Measurements were very adequate. Examination at the eighth month of pregnancy revealed a breech presentation. This position was verified by the x-ray. Several attempts to do external version failed in spite of the fact that this patient presented a rather pendulous abdominal wall and was completely relaxed. History of previous pregnancies was that she had had a breech presentation in her first pregnancy but an external version was successfully performed. The patient went through a normal delivery. Second pregnancy was entirely normal with the patient in labor about three hours.

Patient was admitted to the hospital in labor at full term at 11:30 A.M. after she had been in labor for two hours at home. The fetus was in the S.L.A. position with a complete breech presenting. The fetal heart rate was 148 and of good quality. The patient was in good condition but complained that the pains were more severe than they had been with the two previous deliveries. At 12:00 o'clock the patient was given rectal anesthesia. At 2:00 P.M. the membranes ruptured spontaneously and the cervix was fully dilated. The fetal heart rate at this time was 156 and of good quality. The breech advanced rather slowly and at 3:00 P.M. when the fetal heart rate had accelerated to 164, a foot was drawn down and the fetus delivered in the normal manner at 3:15 P.M. After the umbilicus had passed the vulva, an attempt was made to pull the cord down and relieve tension but this was impossible. The shoulders and the head were quickly delivered, and the umbilical cord was tightly wound about the neck six times. The child was rather flaccid for a short time but was quickly resuscitated. There was no excessive bleeding and the placenta delivered spontaneously ten minutes after delivery. The cord was of very small diameter, about the size of an ordinary lead pencil, and measured 126 cm. The circumference of the infant's neck was 19 cm. which, when multiplied by six, gives 114 cm., the total length of the cord utilized by coiling about the neck. This amount subtracted from 126 cm., the actual length of the cord, leaves only 12 cm. of available cord. This is indeed much too short to allow normal

\*From the Obstetrical Section, Station Hospital, Schofield Barracks, Territory of Hawaii.

delivery in the average case, and I was very fortunate to have no serious complications develop in the delivery of this case. There was normal recovery for the mother, and the child was in excellent condition when discharged from the hospital.

Shortness of the umbilical cord was not suspected in this case. However, the inability to do external version and the increased pain with uterine contractions should have led me to suspect this condition.

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### INCOMPLETE BIPARTITE UTERUS WITH UNILATERAL HEMATOCOLPOS AND SALPINGITIS

GEORGE L. CARRINGTON, A.M., M.D., BURLINGTON, N. C.

THIS case is reported for two reasons. The first is to call attention to the occasional usefulness of the x-ray when it is desired to show both external contour and internal arrangement. This can be accomplished as here shown by the aid of an opaque substance for internal injection and external application. The second reason is the interest of the case itself. The only thing that prevented this from being a uterus didelphys was a communication for a distance of about a quarter of an inch between the two cervical canals. There was a double vagina. The left was imperforate and filled with blood, constituting a hematocolpos. On the left side also, the patient had an acute salpingitis and ovarian abscess. The right tube and ovary were normal. It is interesting that the tube on the side of the imperforate vagina should have been the one infected.

C. L. L., white, eighteen years of age, single. Rainey Hospital No. 6887. Admitted April 28, 1930. Discharged May 24, 1930.

The patient applied for treatment because of lower abdominal pain and leucorrhea. Her past history was essentially uninteresting except as it concerned the present illness. She had menstruated normally since beginning at the age of fourteen years. For one year previous to admission, she had been troubled by leucorrhea. For two months she had had lower abdominal pain and tenderness.

Physical examination showed a slightly underweight, mildly anemic girl of about eighteen years with evident sex appeal. There were slight elevations of temperature, pulse, and leucocyte count, and diminution of red cell count and hemoglobin. The general physical and laboratory examinations were otherwise essentially negative except for the findings in the pelvis and abdomen.

Pelvic examination revealed a tender mass bound down in the culdesac extending to the left. The cervix was normal to inspection and palpation. There was a small, soft cystic mass along the left vaginal wall extending the whole length of the vagina.

May 1, 1930, operation. Preliminary dilatation of the cervix and curettage of the uterine cavity were done. The endometrium was hypertrophied and bled rather freely.

A lower midline incision was then made in the abdomen. The left fallopian tube was acutely inflamed and distended with pus. The left ovary was abscessed. Tube and ovary were adherent to the peritoneum in the culdesac. The uterus was bicornuate. We removed both tubes, the left ovary, the supravaginal portion of

the uterus and the appendix. As we cut across the cervix, about two ounces of old blood oozed up into the pelvis, from the cystic mass that we had described along the left vaginal wall at the time of examination but had failed to recognize as a hematocolpos. There was an anomalous fibrous cord across the floor of the pelvis extending from the cervix backward in the midline to the lower sacrum. We peritonealized all raw surfaces and closed the abdomen tight. A smear from the left tube showed diplococci, that were not further identified.

The patient did not stand her operation particularly well, so after closure of the abdomen, she was returned to the ward and the vaginal plastic left until six-

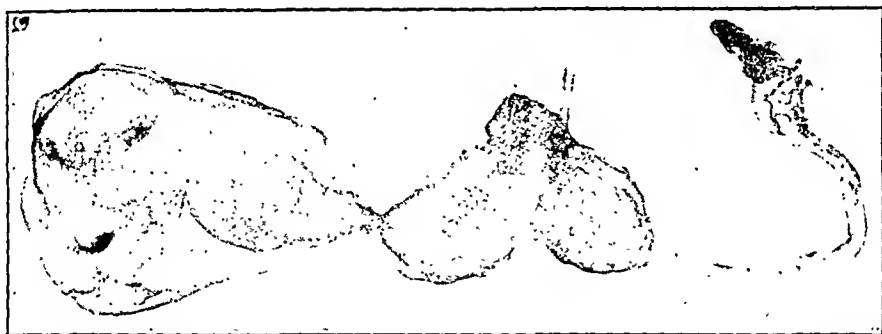


Fig. 1.—Bicornuate uterus with unilateral salpingitis. Uterine cavity injected and surface of specimen painted with sodium iodide.

teen days later. At that time under light gas anesthesia, we excised the partition between the two vaginas. Examination then showed two cervices, one opening in each vagina. About one-half of an inch from the external os, however, the cervices joined and just above this junction there was for a distance of about one-fourth inch a communication between the two cervical canals. This had not been recognized during the preliminary dilatation and curettage of the uterus. This communication had prevented the formation of a large hematocolpos on the left side and at the same time had allowed the development of an acute inflammation in the left tube from organisms that gained entrance through the right vagina.

The patient made a good recovery and has a typical storybook ending of marrying and living happily.

Our thanks are due to Dr. B. B. McDade for his interest in making the x-ray photograph of this specimen of the excised uterus and tubes.



# Society Transactions

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## CENTRAL ASSOCIATION OF OBSTETRICIANS AND GYNECOLOGISTS

Fourth Annual Meeting. Memphis, Tenn.

SEPTEMBER 15, 16, 17, 1932

The following papers were presented:

**A Naegele Pelvis With Coincidental Deformities of Genital Tract and Extremities.** Dr. J. R. Reinberger, Memphis, Tenn. (See page 834.)

**Endometrial Hyperplasia.** Dr. L. E. Burch and Dr. J. C. Burch, Nashville, Tenn. (See page 826.)

**A Consideration of the Schneider Modification of the Aschheim-Zondek Test as Related to Private Practice.** Dr. H. S. Morgan, Lincoln, Neb. (See page 816.)

**The Test of Labor.** Dr. L. Rudolph, Chicago, Ill. (See page 840.)

**Suppurative Mastitis.** Dr. R. A. Johnston, Houston, Tex.

**The Toxic Psychoses of Pregnancy and the Puerperium.** Dr. L. S. McGoogan, Omaha, Neb. (See page 792.)

**Avitaminosis as a Likely Etiologic Factor in Polyneuritis Complicating Pregnancy.** Dr. R. Luikart, Omaha, Neb. (See page 810.)

**The Importance of the Pulse Rate in Labor.** Dr. B. G. Hamilton, Kansas City, Mo.

**The Dangerous Multipara.** Dr. B. Solomons, Dublin, Ireland.

**Report of a Case of Ablatio Placentae Followed by Sloughing of the Uterus.** Dr. W. A. Coventry and R. J. Moe, Duluth, Minn. (See page 859.)

**Puerperal Gynecology.** Dr. J. L. Bubis, Cleveland, O.

**Trichomonas Vaginalis (Donné).** Dr. I. F. Stein and Dr. E. J. Cope, Chicago, Ill. (See page 819.)

**The Fallacies of Trichomonas Vaginalis Vaginitis: Streptococci as the Etiological Agent.** Dr. H. C. Hesseltine, Chicago, Ill. (Will appear in the July issue.)

**Blood Studies in Pregnancy and the Puerperium.** Dr. W. J. Dieckmann and Dr. C. Wegner, St. Louis, Mo. (To be published later.)

**Etiology of Prolapse.** Dr. E. von Graff, Iowa City, Iowa. (See page 800.)

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